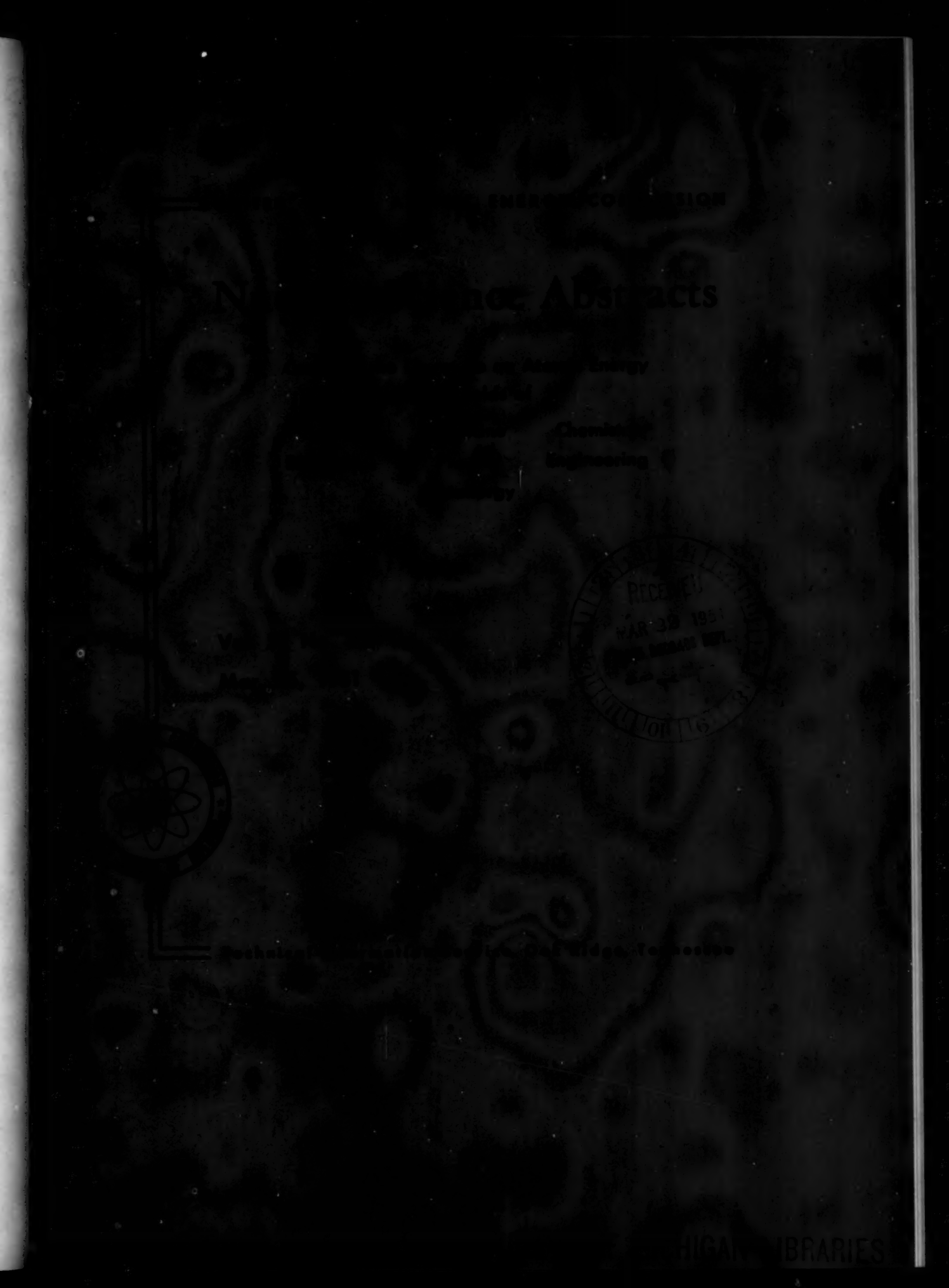

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Indexes

Volumes 1, 2, 3, and 4 of Nuclear Science Abstracts are cumulatively indexed by Author, Subject, and Nuclide in Volume 4, No. 24, Dec. 30, 1950. The cumulative Numerical Index of AEC Reports, described on the inside back cover, is published with Volume 4, No. 24.

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ERRATUM

NSA, Vol. 4, No. 24B, p. 1187. In the definitions of abbreviations and code designations, change AECD (second item in column 2) to AECU.

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GENERAL

ATOMIC POWER

904

PRODUCTION OF ATOMIC ENERGY BY NUCLEAR REACTIONS. Paul Wessel. Atomics 6, No. 6, 23-9(1950) Nov.-Dec.

A general review of the present state of development of nuclear energy is presented. In this short article, Dr. Wessel begins with a description of the atom in the light of modern physics and traces the development of nuclear energy from the early work of Rutherford to the practical attainment of nuclear fission. The most fundamental reactions are presented in detail. (auth)

BIOLOGY AND MEDICINE

905

University of California at Los Angeles
THE MEASUREMENT OF CARDIAC OUTPUT AND THORACIC BLOOD VOLUME BY THE CONSTANT INFUSION METHOD. Alvin E. Lewis, Raymond D. Goodman, and Morton L. Pearce. Nov. 15, 1950. 18p. (UCLA-97)

By continuous photoelectric recordings of dye concentrations in plasma, it has been shown that before recirculation occurs, a constant concentration level is obtained during a constant infusion. Cardiac output is measured by the ratio of infusion rate to plasma concentration at the constant level. From the curves preceding this plateau, it is possible to measure the effective thoracic blood volume, i.e., the blood content of the heart and lungs. The constant infusion method eliminates the inaccuracies and technical difficulties of Fick-principle methods. The constant infusion method is simpler and has greater potential usefulness than the single-injection methods. (auth)

906

THE DETERMINATION OF RADIOACTIVE IODINE IN BIOLOGIC MATERIAL. J. E. Rall, Herbert W. Johnson, Marschelle H. Power, and A. Albert. Proc. Soc. Exptl. Biol. Med. 75, 390-2(1950) Nov.

A convenient and sensitive measurement of as little as 3×10^{-5} μc of I^{131}/cc of serum is possible by a modification of the Chaney iodine-distillation technique. It is possible to determine the concentration of I^{131} in serum of patients during a half life of I^{131} following administration of doses of about 20 μc.

907

EFFECT OF BERYLLIUM ON IN VITRO CALCIFICATION OF CARTILAGE. T. F. Yü and Alexander B. Gutman. Proc. Soc. Exptl. Biol. Med. 75, 481-4(1950) Nov.

Be in concentrations of 1.0×10^{-5}M or greater is a potent inhibitor of the dephosphorylating activity of cartilage alkaline phosphatase. In concentrations of 10^{-5}M or greater, Be completely blocked in vitro calcification of cartilage when P was supplied as β-glycerophosphate, phenylphosphate, or creatine phosphate. When P was supplied as inorganic phosphate (the condition apparently obtaining in vivo), concentrations of Be sufficient to produce marked inhibition of alkaline phosphatase failed to interfere with in vitro calcification of cartilage. The significance of these findings in relation to current theories of endochondral calcification and "beryllium rickets" is discussed. (auth)

RADIATION EFFECTS

908

University of Chicago Metallurgical Laboratory
THE BIOLOGIC EFFECTS OF RADIATION; TRAINING PROGRAM LECTURE NOTES. S. T. Cantril. May 17, 1943. Decl. May 22, 1950. 10p. (AECD-2976; CL-551)

Training program lecture notes are presented covering specific ionization, the effective penetrability of the radiation, the time factor, the total dose, radiosensitivity, and the tolerance dose in relation to occupational radiation hazard. It is concluded that, when protection is possible to attain, it should be used. The 0.1 r per day for the skin dose as well as for total body radiation by γ rays has been held as a standard; the neutron tolerance level is placed at 0.01 r per day. These tolerance levels for the present are thought to be adequate without overemphasizing safety at the expense of getting the job done.

909

Biological Laboratory, Cold Spring Harbor
GENETIC CHANGES WITHIN POPULATIONS AFTER X IRRADIATION. Bruce Wallace. [nd.] 26p. (AECU-1107)

Genetic analyses have been made of populations of Drosophila melanogaster exposed to single x-ray treatments. The parental males of population 1 received 7125 r; females of population 1 and males and females of population 2 received 1012.5 r; the flies of population 3 were untreated. Before

treatment, all flies carried second chromosomes that were free of lethals and drastic subvitals. The recessive lethals of population 1 decreased from an original 18.3 to 10.1% in approximately four generations and then increased at at rate comparable to that of the control. The early elimination of lethals from population 1 indicated a selective disadvantage of heterozygotes of 0.5, and was adequately explained by lethal-translocation association. Analyses of lethals, semilethals, average viabilities of flies homozygous for "normal" chromosomes, and variances of the array of "normal" viabilities indicate that changes occurred at a more rapid rate in population 1 than in the control. The discussion touches briefly on general problems of irradiated populations. (auth)

910

Brookhaven National Laboratory
CHANGES IN ANTIDIURETIC ACTIVITY OF RAT SERUM AFTER X-IRRADIATION. Abraham Edelmann and W. J. Eversole. [nd.] 1p. (AECU-1081)

The report is reproduced here in its entirety.

The experiments reported here concern an attempt to determine the physiology involved in the previously reported (Federation Proc. 8, 39(1949)) diuresis occurring within 24 hr after whole-body x irradiation of the rat. A test dose of water, 4 ml/100 cm^3 body surface, was given by stomach tube 30 min or 24 hr after whole-body x irradiation (160 kvp, 10 ma, 0.2 mm Cu). Control animals were similarly treated except they were not irradiated. Exposed animals excreted the administered water at a more rapid rate than the controls. Serum taken from irradiated rats at various times after exposure was tested for antidiuretic activity by the method of Birnie et al. (Proc. Soc. Exptl. Biol. Med. 70, 83(1949)). Significant decreases in antidiuretic activity were found at 12 and 24 hr after irradiation. These results indicate that a decrease in amount of circulating antidiuretic substance or substances is a factor involved in the increased urine flow after irradiation.

911

University of Chicago Metallurgical Laboratory
COMPARATIVE LETHAL ACTION OF X RAYS AND CYCLOTRON NEUTRONS ON DROSOPHILA EGGS. Raymond E. Zirkle and Mary Ellen Parrish. Dec. 1950. 6p. (CH-3904)

The x rays were generated at 200 kv and 5 ma and were filtered by 0.5 mm of Cu and 1 mm of Al. The target-to-object distance was adjusted to give a dose rate of about 10 r/min. The fast neutrons were generated by 8-Mev deuterons impinging on a Be probe in the University of Chicago cyclotron. The eggs were exposed in a lead-walled chamber which was so constructed that radiation directly from the probe was filtered through 4 in. of Pb, while scattered radiation from other directions was filtered through at least 2 in. Various lots of eggs were given graded doses of x rays, of fast neutrons, and of mixed neutrons and γ radiation. The LD_{50} of x rays is 170 r, that of fast neutrons is 31 n, and that of the mixed cyclotron emission is 43 Victoreen scale units. Accordingly the x/n dosage ratio is 170/31 or 5.5, whereas the apparent x/n ratio, from data obtained when γ rays were present, is 170/43 or 4.0.

912

University of Rochester Atomic Energy Project
THE EFFECTS OF CHRONIC EXPOSURE TO ROENTGEN RADIATION ON THE PERIPHERAL BLOOD OF EXPERIMENTAL ANIMALS. M. Ingram and W. B. Mason. July 17, 1950. 23p. (UR-121)

Routine hematological examinations have been done repeatedly on dogs, rabbits, rats, and monkeys which have been exposed to daily doses of whole-body roentgen radiation in amounts near the tolerance range, i.e., doses varying from 0.1 to 10.0 r/day. These dosages have been administered for a continuous period of not more than 2 yr. Both 250- and 1000-kvp machines were used. During the experiments the rats and monkeys acquired extraneous pathology of such a degree that it was necessary to exclude these animals. In dogs and rabbits, changes in the hemograms which followed chronic exposure were detected only by statistical methods. It would seem unlikely that routine hematological examination would provide a reliable means of detecting minimal radiation damage in any one animal. Lymphocytes appear to be the most sensitive hematological indicators of the damage which results from chronic exposure to roentgen radiation. The least sensitive element in the peripheral blood appears to be the mature erythrocyte. The effectiveness of small daily doses of roentgen radiation in producing hematological changes is dependent, in part, on the duration of such exposure. In some instances, changes were first noted during the second year of daily exposure. The data demonstrate a marked difference in the hematological responses of dogs and rabbits exposed daily to the same doses of radiation. The reticulocyte depression, relative to that of the lymphocyte, is less pronounced in the present experiments than in the case of exposure to single large doses of whole-body roentgen radiation. Chronic exposure did not elicit the marked reticulocytosis which characterized the recovery response to acute exposure. No consistent difference was observed in the hematological changes which followed exposure to like quantities of roentgen radiation from the 250- and the 1000-kvp machines.

913

APPLICATION OF THE CONCEPT OF ENTROPY TO CELL REACTIONS, CONSIDERED AS A FUNDAMENTAL BIOLOGICAL LAW. Luigi Turano. Radiologia Med. 36, 116-29(1950) Feb. (In Italian)

Notwithstanding apparent proofs to the contrary, the reaction of a living cell to ionizing radiations is to hasten either death, or senescence, or degeneration, all of which are various degrees of dissipation or degradation of energy, of irreversible approach toward greater molecular disorder and states of higher statistical probability or entropy. A significant exception is the action of radiations on chromosomal genes, which should be regarded (What Is Life? Schroedinger. Cambridge University Press, 1945) as a nonstatistical excitation of a single microcosmical mechanism toward a different state. However, such an excitation can ultimately express itself in a number of various mutations, among which is a return to the original state; this shows that even here the elements of random and of incomplete reversibility play their inevitable part.

914

Naval Medical Research Institute
THE BIOCHEMICAL, CELLULAR, AND BACTERIOLOGIC CHANGES IN THORACIC DUCT LYMPH OF DOGS EXPOSED TO TOTAL BODY IRRADIATION. Crawford S. Brown, Esther Hardenbergh, and John L. Tullis. June 22, 1950. 15p. (NP-1762)

A study of the biochemical, cellular, and bacteriologic changes in lymph produced by 500 r of total-body irradiation in dogs was undertaken in order to compare them with changes which have been found to occur in blood. Forty dogs were divided into 9 groups, each group representing a different time interval through 132 hr after irradiation. Dogs were anesthetized with nembutal, the thoracic ducts were cannulated with siliconed glass tubing, and the lymph fistulae allowed to drain for 6 to 10 hr. Lymph samples were taken every 1 to 2 hr. Blood samples were taken at longer intervals. Changes, with time after irradiation, of protein level, creatine, uric acid, sugar, and other components are discussed.

915

Naval Medical Research Institute
THE EFFECT OF ADRENALECTOMY ON RADIATION INDUCED MORTALITY OF THE MOUSE. E. P. Cronkite and W. H. Chapman. June 27, 1950. 7p. (NP-1875)

The adrenalectomized or "adrenal insufficient" mouse is found to be more sensitive to irradiation than the normal mouse. The survival time of adrenalectomized mice is shortened. The cause of death in the adrenalectomized irradiated mouse is apparently due to mechanisms other than infection and hemorrhage. (auth) (See also NSA abstract 4-4731.)

916

EFFECTS OF X-IRRADIATION ON PASSIVELY TRANSFERRED ANTIBODY. J. W. Hollingsworth. Proc. Soc. Exptl. Biol. Med. 75, 477-9(1950) Nov.

X irradiation in dosage of 300 r had no effect on the rate of destruction of passively transferred homologous or heterologous antisera given intravenously to rabbits 24 hr after irradiation. This x-ray dosage was sufficient, however, to decrease, but not totally prevent, the formation of antibody to the heterologous serum proteins. (auth)

917

THE EFFECTS OF X IRRADIATION ON RANA PIPIENS (LEOPARD FROG), WITH SPECIAL REFERENCE TO SURVIVAL AND TO THE RESPONSE OF THE PERIPHERAL BLOOD. S. Phyllis Stearner. J. Exptl. Zool. 115, 251-62 (1950) Nov.

Survival of the frog, Rana pipiens, was observed following x-ray dosages ranging from 600 to 2000 r. The greatest number of deaths occurred between 2 and 5 weeks after exposure to dosages below 1200 r, and deaths reached a minimum after 6 weeks. Exposure to 700 r resulted in 50% mortality at 6 weeks. Comparison with survival studies on irradiated mammals indicates that in the frog there is a wider range of dosages producing less than 100% mortality and that the slope of the survival curve is not as great. The cells of the circulating blood of the frog include the types characteristic of higher vertebrates. Peripheral blood counts following exposure to 600 and 900 r indicate that the relative sensitivities of the leukocytes to radiation injury were similar to those of most mammals; however, the response following irradiation occurred more slowly than in most mammals and indicates that the lower metabolic rate of the frog may increase the duration of the so-called latent period. No significant effect was seen on the number of thrombocytes or erythrocytes, or on the hemoglobin concentration. It is suggested that the relatively long life span of the erythrocytes would mask any but a prolonged decrease in erythropoiesis. (auth)

918

Naval Medical Research Institute
EXPERIMENTAL PROCEDURES FOR THE SIMULTANEOUS EXPOSURE OF LARGE NUMBERS OF ANIMALS TO TOTAL BODY X RADIATION. W. H. Chapman, E. P. Cronkite, F. W. Chambers, Jr., and J. E. Morgan. July 3, 1950. 12p. (NP-1877)

Methods are described for simultaneously exposing large numbers of mice, rats, guinea pigs, rabbits, or dogs to the same rate of x radiation. This is accomplished by exposing animals in specially constructed irradiation cages which are positioned in the field of maximum uniform intensity of the radial beam of 1- and 2-Mev x-ray units. Methods are also described for studying the mortality of mice exposed simultaneously to different rates or to high rates of x radiation. By simultaneously exposing large numbers of animals in individual cages it is possible to minimize many extraneous physical factors and obtain in a single experiment statistically reliable data on factors which may influence the mortality of radiation illness. (auth)

919

Herman et Cie., Publishers
EXPERIMENTAL RADIOPHYSIOLOGY; CANCERS AND HORMONES; IV. CANCERS PRODUCED BY CORPUSCULAR RADIATIONS (A PROPOSED MECHANISM OF RADIATION CARCINOGENESIS). Antoine Lacassagne; tr. by Inez C. O'Brien. 1945. 115p. (NP-2226; Scientific and Industrial Progress Publications 981; Translation - 23(UCRL))

Clinical observations and animal experiments by which knowledge has been obtained on cancers produced by corpuscular radiation from radioactive bodies are presented. Only the natural radioactive substances are discussed. Chapters on the following are included: emission of corpuscular radiation in the organism; cancers produced by radioactive foyer inserted into the organism; cancers produced by the injection of radioelements into the organism; cancers produced by ingestion of radioelements; inhalation of radioactive elements and cancers of the lung; attempts to analyze the conditions of cancerism by radiation; and action of radiation on certain elementary living forms.

920

Naval Medical Research Institute
MORTALITY IN SWINE AND DOSE DISTRIBUTION STUDIES IN PHANTOMS EXPOSED TO SUPER-VOLTAGE X

RADIATION. John L. Tullis, F. W. Chambers, Jr., J. E. Morgan, and John H. Zeller. Aug. 29, 1950. 21p. (NP-1887)

Lethal dose curves established for 110- to 160-pound swine exposed to 2000-kvp total-body x radiation at 2 m indicate that bilateral (one-half the total dose to each lateral aspect) irradiation is more lethal than unilateral (total dose to one lateral aspect) irradiation. The 2000-kvp bilateral x radiation is also more lethal than 1000-kvp bilateral x radiation. The $LD_{50/30}$ values for each technique at 2 m are 350 to 400 r for 2000-kvp bilateral, 500 r for 2000-kvp unilateral, and 510 r for 1000-kvp bilateral exposure. Depth dose values taken throughout a 28-cm phantom show that the internal distribution of incident radiation is more uniform when it is divided and administered bilaterally. In the case of 1000-kvp bilateral exposure, while the per cent air dose at the periphery is comparable with that in 2000-kvp bilateral exposure, the fall off in the mid-portion of the phantom is considerably more. The dependence of dose distribution on method of x radiation and wavelength of the source is demonstrated. The importance of uniform dose distribution and the difficulties in obtaining same in a subject 28 cm thick are discussed. (auth)

921

PROTECTIVE ACTION OF SODIUM NITRIDE AGAINST LETHALITY PRODUCED BY X RAYS IN MICE. A. Hervé and Z. M. Bacq. Compt. rend. soc. biol. 144, 1124-5(1950) Aug. (In French)

It has been reported in former notes that an injection of 0.1 mg of NaCN immediately before a 700-r irradiation of mice reduced the lethality by 70% (Compt. rend. soc. biol. 143, 881(1949); Betz and Hervé, ibid. 144, 1015(1950)). An analogous series of experiments is described here using Na_3N, whose biochemical properties (inhibitions of enzyme functions) are similar to those of NaCN. An injection of 0.1 to 0.2 mg of Na_3N in aqueous solution in mice before the administration of 700 r of x rays reduced the lethality by 60%.

922

Naval Medical Research Institute
SULFHYDRYL-CONTAINING AGENTS AND THE EFFECTS OF IONIZING RADIATIONS; III. STUDIES ON THE MECHANISM OF THE PROTECTIVE ACTION OF GLUTATHIONE. Eugene P. Cronkite, George Brecher, and W. H. Chapman. June 27, 1950. 15p. (NP-1876)

After injection of reduced glutathione, clearance and tissue distribution studies were performed in mice, dogs, and rats. Animals were irradiated during a period when tissue concentration of reduced glutathione was significantly elevated. Following irradiation of mice with 820 r, granulocytes and lymphocytes were apparently absent from the blood of the untreated mice for a few days. During this same period granulocytes and lymphocytes were seen in small numbers in the blood of glutathione-treated mice. The spleen and thymus of irradiated glytathione-treated mice recover normal weight more rapidly than untreated mice. Histologically, hematopoiesis returns earlier and with greater frequency in the treated mice than in the untreated mice. Dogs are also partially protected from radiati · by intravenous glutathione, 50% recovering from a dose of radiation that has so far been uniformly fatal to untreated dogs in this laboratory. 15 references. (auth)

RADIATION HAZARDS AND PROTECTION

923

Oak Ridge National Laboratory Chemical Technology Division
ATTENUATION OF BETA RADIATION WITH "ABC COCOON" AND "G.E. COCOON" (STRIPPABLE PLASTIC FILMS). C. D. Watson, G. A. West, and J. C. Suddath. Oct. 12, 1950. 22p. (ORNL-834)

Thicknesses of disposable plastic films required for essentially complete attenuation of β radiation from approximately 0.4 mc of P^{32} and 1 mc of I^{131} were determined and compared to a reference material, lead sheet. Lead sheet ($\frac{1}{32}$ in.) will shield the same radiation sources at approximately 0.25 and 0.75 the material cost of ABC and G.E. Cocoon, respectively.

924

Division of Engineering, AEC
WASTE MATERIALS IN THE UNITED STATES ATOMIC ENERGY PROGRAM. Abel Wolman and Arthur E. Gorman. Jan. 12, 1950. 20p. (WASH-8)

A review of the problem of disposal of waste containing radioactive materials is presented. The problem is discussed as being analogous to other problems of industrial waste disposal. Possibility of radioactive materials becoming dangerously concentrated in algae of streams and in sewer systems is indicated. It is noted that no gaseous material containing radioactivity may be released to the atmosphere. It is concluded that the future growth of this new industry from the developmental stage to that of applied use of its products may well hinge on its ability to find increasingly effective and reasonably economical methods of disposal of its hazardous waste products. 23 references.

925

Westinghouse Research Laboratories
BACK-IONIZATION IN ELECTROSTATIC PRECIPITATION. G. W. Penney and G. W. Hewitt. [nd.] 15p. (NP-1618)

In electrostatic precipitation, "back-ionization" is a faulty condition of the ionizer in which discharges at the large electrode cause partial neutralization of the charge acquired by the dust particles. In collecting high-resistivity dust the voltage drop across the dust layer on the large electrode may be sufficiently high to cause electrical breakdown through the collected dust. This results in the liberation of ions at the surface of the dust layer, of the sign opposite to that of the ions furnished by the normal discharge from the wire. The resulting partial neutralization of the charge acquired by the suspended dust particles causes a loss in cleaning efficiency. Other troubles are wire vibration and increased ozone generation. Back-ionization usually can be eliminated by operating at a higher relative humidity or by using a liquid on the large electrode surfaces, preferably one having a resitivity of less than 10^9 ohm-cm. (auth)

926

THE EMERGENCY CARE OF ATOMIC BOMB CASUALTIES. PART I. THE BOMB AND ITS EFFECTS. Theodore P. Eberhard, ed. Philadelphia Med. 46, 533, 535, 537, 545(1950) Dec. 2.

The first of a series of brief lectures designed to inform doctors of the problems likely to be faced during the first 48 hr after an atomic-bomb attack and to enable them to train the thousands of laymen needed for rescue and first aid is presented. The nature of and damage caused by an atomic explosion is discussed briefly.

927

EMERGENCY CARE OF ATOMIC CASUALTIES. PART I. THE BOMB AND ITS EFFECTS (CONTINUED). Theodore P. Eberhard, ed. Philadelphia Med. 46, 561, 563(1950) Dec. 9.

Problems of organization for meeting the emergency created by an atomic-bomb attack are considered briefly.

928

THE EMERGENCY CARE OF ATOMIC BOMB CASUALTIES. PART II. THE PHYSICAL FOUNDATION OF THE ATOMIC BOMB AND ITS RADIATIONS. Theodore P. Eberhard, ed. Philadelphia Med. 46, 599, 601, 603, 605(1950) Dec. 16.

An elementary, very brief review of some aspects of fission and atomic explosions is presented.

929

THE EMERGENCY CARE OF ATOMIC BOMB CASUALTIES. PART III. THE EFFECTS OF RADIANT ENERGY ON HUMAN BEINGS. Theodore P. Eberhard, ed. Philadelphia Med. 46, 631, 633, 635-6(1950) Dec. 23.

To justify the assumption that all radiation effects are the results of ionization, a brief explanation of atomic and molecular systems is given. Radiation effects of the atomic bomb at Hiroshima and related facts are discussed. Following first aid treatment the following recommendations are listed for treatment of atomic-bomb-radiation victims: (1) bed, (2) antibiotics, particularly aureomycin, (3) blood transfusions as needed, (4) antihemorrhagic substances, and (5) nourishment by whatever route possible.

930

THE EMERGENCY CARE OF ATOMIC BOMB CASUALTIES. PART IV. FIRST AID AND TRANSPORTATION OF WOUNDED. Theodore P. Eberhard, ed. Philadelphia Med. 46, 661, 663, 665(1950) Dec. 30.

The first aid and transportation that must be given to patients with soft-tissue wounds is outlined. That this work will have to be done by trained laymen is stressed.

931

EMERGENCY CARE OF ATOMIC BOMB CASUALTIES. PART V. THE RECOGNITION AND TREATMENT OF SHOCK. Theodore P. Eberhard, ed. Philadelphia Med. 46, 697-8(1951) Jan. 6.

Proper treatment of shock under conditions of an atomic-bomb attack presents an almost unsolvable problem. A brief discussion is given of what can be done and incorrect procedures to avoid.

932

EMERGENCY CARE OF ATOMIC BOMB CASUALTIES. PART VI. THE EMERGENCY TREATMENT OF FRACTURES. Theodore P. Eberhard, ed. Philadelphia Med. 46, 721-3(1951) Jan. 13.

Training of first aid teams in handling patients buried under debris, improvisation of splints from wreckage, and priority of treatment are discussed briefly.

933

EMERGENCY CARE OF ATOMIC BOMB CASUALTIES. PART VII. THE TREATMENT OF BURNS. Theodore P. Eberhard, ed. Philadelphia Med. 46, 751, 753, 755(1951) Jan. 20.

Descriptions of the effects of thermal burns, a plan for treatment in civilian defense, and notes on emergency treatment of extensive burns are presented. Recommendations on the intake of fluids and electrolytes, use of antibiotics (procaine, penicillin, etc.), and diet are made.

934

GERMAN AND FOREIGN REGULATIONS FOR X-RAY PROTECTION IN MEDICAL ROENTGEN UNITS. R. Glocker. Fortschr. Gebiete Röntgenstrahlen 73, 13(1950).

The existing regulations for protection against radiation damage in medical laboratories in Germany, United States, England, and Sweden are compared. The maximum dose per hour, day, and week; maximum permeability of the hood of the x-ray tube; minimum thickness of Pb aprons and gloves; special regulations concerning protection against dispersion of the rays in therapy units; maximum working hours; and minimum vacation time are reported.

RADIATION SICKNESS

935

HEMATOLOGY OF ATOMIC BOMB CASUALTIES. George V. LeRoy. Arch. Internal Med. 86, 691-710(1950) Nov.

Data from the detailed hematological studies made on Japanese injured by the atomic-bomb explosions over Hiroshima and Nagasaki indicate that it is possible to describe the syndrome of radiation injury in man in terms of typical clinical symptoms and a typical blood picture. The time trend of the syndrome is important, and the characteristic elements in the diagnosis become apparent at various times after exposure. In general, the severity of the symptoms paralleled the severity of the leukopenia. Likewise, the important symptoms became evident at about the time the lowest leukocyte count was observed. The changes in the thrombocytes paralleled those in the leukocytes. The onset and severity of a hemorrhagic tendency followed closely the variations in the thrombocyte

count. The alteration in the red blood cells was less consistent and less useful in diagnosis or prognosis than was the time trend of the leukopenia. From the standpoint of prognosis, the Japanese physicians stated that patients with less than 500 leukocytes per mm^3 were least likely to recover. The data presented here neither support nor deny this clinical observation. In the event of an emergency, it would be perfectly justifiable to perform only leukocyte counts and determinations of hemoglobin, hematocrit, and protein by the copper sulfate method. This would be an economical procedure and would provide the type of information required to evaluate individual cases and to aid in control of therapy.

936

THE PROTECTIVE EFFECT OF CYSTEINE ON LEUCOPENIA INDUCED BY NITROGEN MUSTARD. Austin S. Weisberger and Robert W. Heinle. J. Lab. Clin. Med. 36, 872-6(1950) Dec.

Administration of cysteine to rabbits before injecting nitrogen mustard (HN_2) results in protection against the leucopenia induced with HN_2. Administration of cysteine immediately after injecting HN_2 does not result in any protection against the leucopenia; also, 25 mg of BAL in oil per kilogram of body weight did not prevent the leucopenia. A marked rise in neutrophils occurs on the second day following the injection of HN_2. This is similar to that which appears following irradiation. Administration of cysteine prior to the injection of HN does not prevent the typical rise in neutrophils. (auth)

937

THE RADIOACTIVE EFFECTS OF ATOMIC WEAPONS. Asher A. White. Minnesota Med. 33, 1085-7, 1114(1950) Nov.

A general, nontechnical discussion of radiation effects of an atomic explosion, relative radiation sensitivity of various tissues and organisms, and types, complications, sequelae, and treatment of acute radiation sickness is presented.

RADIOGRAPHY

938

Los Alamos Scientific Laboratory
SELECTION OF ISOTOPE FOR RADIOAUTOGRAPHY AND NETWORK CHART FOR EXPOSURE CALCULATION. Wm. Ward Wainwright, Ernest C. Anderson, Preston C. Hammer, and Charles A. Lehman. [nd.] 10p. (AECU-997; LADC-864)

The advantages of careful choice of isotope for radioautography experiments is illustrated by plotting the sharpness or the spread in photographic emulsion of the radiations of various isotopes. The effect of the half life on the total exposure is considered. A network chart relating exposure time, activity, and half life which is based on the formula of Axelrod and Hamilton (Am. J. Path. 23, 389(1947)) is presented.

939

AN IMPROVED TECHNIQUE FOR RADIOAUTOGRAPHING OF DUSTS. Saul J. Harris. [nd.] 2p. (AECU-1083)

Greatly increased sensitivity in monitoring low-level contamination with settling trays may be obtained by exposing the collected dust to photographic film in a dark room with sheet rubber hydrochloride, 0.0002-in. thick, as a contamination barrier between film and dust, and by using ½-in. foam rubber cemented to plywood as a pressure plate.

RADIOTHERAPY

940

APPLICATIONS OF RADIOACTIVITY IN CLINICAL MEDICINE. Wallis L. Craddock. Mississippi Valley Med. J. 73, 2-7(1951) Jan.

Following a brief reference to the history of radiology, discussions of medical applications of I^{131}, P^{32}, Na^{24}, and Fe^{59} are presented.

941

ISODOSE MEASUREMENTS OF LINEAR RADIUM SOURCES IN AIR AND WATER BY MEANS OF AN AUTOMATIC ISODOSE RECORDER. Gerald J. Hine and Milton Friedman. Am. J. Roentgenol. Radium Therapy 64, 989-98(1950) Dec.

By means of an automatic isodose recorder, which employs a scintillation crystal as a radiation detector, isodose curves around radium sources can be measured in a short period of time with a good degree of accuracy. With certain exceptions, the isodose curves obtained with this instrument conform with isodose curves constructed mathematically. Commonly employed radium tubes show an asymmetrical isodose pattern. Increasing the filtration of a radium source reduces the intensity and flattens the isodose curves at the tube ends. The presence of a scattering medium (water) surrounding the radium source raises the dose at points not too close to the source by at least 10%. (auth)

942

MOLDED RADIUM SUPPORT FOR INTRACAVITARY TREATMENT OF PHARYNGONASAL TUMORS. Pierluigi Cova. Radiologia Med. 36, 217-21(1950) Mar. (In Italian)

For the intracavitary treatment of pharyngonasal tumors the author uses a radium support molded in the shape of the cavity. The cast is made in paste used by dentists for imprints. It is held in place by two threads passing through the nasal fossae, while an additional safety thread passes through the mouth.

943

RADIOACTIVE IODINE IN THE TREATMENT OF THYROID DISEASES. A REVIEW OF THE LITERATURE AND PRELIMINARY REPORT OF CASES TREATED. M. Weinbren. S. African J. Clin. Sci. 1, 213-88(1950) Sept.

The historical, physiological, and physical aspects of radioactive iodine therapy are reviewed. The results re-

ported in the literature, which cover some 500 cases treated in the United States of America, are reviewed and discussed. The difficulties of using radioactive iodine in South Africa are discussed, and the dangers involved are indicated. Cases treated by the author, representing the various types and their responses to radioactive iodine, are described.

944

THE SIXTEENTH MEETING OF THE ITALIAN SOCIETY FOR MEDICAL RADIOLOGY. A. Ratti. Radiologia Med. 36, 664-72(1950) Aug. (In Italian)

Among the notes on papers read at Taormina in May, 1950, the following deal with the radiology of the cancer: Radiodiagnosis of Cerebral Tumors, F. Mascherpa; Radiotherapy of Malignant Tumors of the Reticulo-Endothelial Systems, G. F. Gardini; Radiotherapy of Diseases of the Metabolism, P. Cignoligni.

945

Division of Atomic Energy, NRC
SOME PROBLEMS ARISING IN THE DOSIMETRY OF ARTIFICIAL RADIOACTIVE SUBSTANCES AND HIGH ENERGY QUANTA. II. W. V. Mayneord. July 1946. 36p. (CRM-315(Rev.))

Dosimetry of β-ray emitters; integral dose; the dosimetry of γ-ray emitters; further examples of mixed γ-ray emitters; radiation distribution in a uniformly filled sphere; radioactive distribution due to emitters of other shapes; dose at the center of an absorbing sphere; calculated doses when absorption in the medium is included; integral dose in a uniformly filled radioactive sphere; theory of radiation fields near solids of revolution; slow-neutron capture in hydrogen; distribution of γ rays near sources of variable ρ (when ρ is a function of position); positron emitters; pair formation from high-energy γ rays; "tolerance dose" for β- and γ-ray emitters; tolerance amounts in very large volumes; biological factors.

946

THERAPY OF MORBUS BASEDOW. Paul Martini. Deut. med. Wochschr. 75, 1109-13(1950) Sept. 1. (In German) (See also following abstract)

The first part of an extensive review of the treatment of exophthalmic goiter and hyperthyroidism by the following means is presented: operation, x irradiation, iodine, radioiodine, and thyrostatic agents.

947

THERAPY OF MORBUS BASEDOW. Paul Martini. Deut. med. Wochschr. 75, 1187-91(1950) Sept. 8. (In German) (See also preceding abstract)

The conclusion of an extensive review of the treatment of exophthalmic goiter and hyperthyroidism by the following means is presented: operation, x irradiation, iodine, radioiodine, and thyrostatic agents. 130 references.

948

TREATMENT OF THE CANCER OF THE BREAST WITH X RAYS ALONE. Livio Macchi. Radiologia Med. 36, 845-59(1950) Oct. (In Italian)

Statistics are reported of 220 cases of breast cancer, both operable and inoperable, treated by x rays alone (no radium or chemicals) at the Curie Foundation, Paris, France. Irradiations of 20 r/min, filtered through 1 mm Cu + 2 mm Al, were applied, at a distance of 60 cm, in doses varying from 4000 to 7000 r, depending on the field and the condition treated. Survival data: 34.07% after 3 yr, and 27% after 5 yr observation. The method can bring about clinical disappearance of the mammary tumor, of supraclavicular adenopathies, and, in a lesser degree, of axillary adenopathies. The statistics are not concerned with possible appearances of distant metastases. The technique is difficult and the treatment long.

TOXICOLOGY STUDIES

949

ACTION OF BERYLLIUM ON ALKALINE PHOSPHATASE. Jean Roche, Nguyen Van Thoai, and Jacqueline Loewy. Compt. rend. soc. biol. 144, 638-40(1950) May. (In French)

Several writers have ascribed certain beryllium toxicoses to the recently observed strong inhibitory action of Be salts on alkaline phosphatase. It is thought that Be enters into competition with Mg, a normal constituent of the enzyme, whereby the action of Mg is replaced by beryllium's specific inhibitory one. However, it is known (Roche et al., Bull. soc. chim. biol. 25, 1166, 1175(1943); Policard et al., Compt. rend. soc. biol. 143, 1411(1949)) that the phosphatase, after having been inhibited by a long dialysis, can be reactivated by supplying any of the bivalent cations Mg^{+2}, Mn^{+2}, or Zn^{+2}; the intensity of the effect depends on the concentration supplied, and the normal action is replaced by an inhibitory one if the concentration exceeds a certain limit characteristic of a given ion; thus, in the case of Zn the limit is very low (about 10^{-5}M), whereas for Mg it is much higher. A series of direct experiments is described here, in which the action of Be^{+2}, alone or in the presence of Mg^{+2}, on dialyzed phosphatase is compared to that of Zn^{+2}. It has been found that the action of beryllium is not specific; similar to that of the other bivalent cations, its action is normal or inhibitory according to concentration, its quantitative aspects being comparable with those of Zn^{+2}.

950

RIEHL'S MELANOSIS AND THE ADRENAL GLANDS. Leo Spira. Arch. Internal Med. 86, 682-90(1950) Nov.

A case of Riehl's melanosis arising from chronic fluorine poisoning is recorded, in which hypopiesia, hypochlorhydria, hypoglycemia, diminished excretion of 17-ketosteriods, high blood urea content and frequent attacks of "influenza" indicated that the adrenal glands were vitally involved.

TRACER APPLICATIONS

951

Duke University
TERMINATION REPORT ON UNCLASSIFIED RESEARCH CONTRACT AT-40-1-289; TITLE IV. A STUDY OF THE

ABSORPTION OF RADIOACTIVE PHOSPHORUS BY PINE SEEDLINGS. Paul J. Kramer. [nd.] 6p. (ORO-8)

A study of the absorption of mineral elements by mycorrhizal and nonmycorrhizal roots of pine seedlings, using P^{32} as an indicator, is reported. From experimental results it is concluded that pine roots show more individual variability than barley roots used in most studies of this type; hence it is more difficult to draw definite conclusions concerning their behavior. It is clear, however, that pine roots are very sensitive to azide and at a low pH to fluoride, and nonmycorrhizal roots are more sensitive than mycorrhizal roots. Oxygen deficiency or an excess of carbon dioxide greatly reduces accumulation of P^{32} by both mycorrhizal and nonmycorrhizal roots of pine.

952

Duke University
THE LOCALIZATION OF POSITRON EMITTING RADIOISOTOPES IN THE BRAIN. Frank Wrenn, Jr., Myron H. Good, and Philip Handler. [nd.] 34p. (ORO-11)

A possible new solution is reported to the problem of detection and localizing of intracranial neoplasms with radioactive materials through the use of the positron-emitting Cu^{64}, carried by the dye copper phthalocyanine. Coincident scintillation counters are used to detect the annihilation quanta. 26 references.

953

University of California Hospital and School of Medicine
THE CORRELATION OF THE INITIAL RATE OF I^{131} UPTAKE IN THE THYROID WITH THE CLINICAL EVALUATION OF THYROID FUNCTION. Earl R. Miller. Oct. 1950. 37p. (UCRL-949)

Data were collected on the I^{131} uptake in the thyroid during the first 7 hr after its administration to a group of patients who were considered clinically to have normal thyroid function and to a group who were considered to be suffering from hyperthyroidism. An attempt was made to find a single quickly obtained value from the uptake curve that might be as useful as the entire uptake curve in differentiating between these groups of patients. The uptake as given by the per cent per hour was tried first. It was calculated by taking the per cent of I^{131} collected by the thyroid during the first few hours and dividing it by the number of hours between the administration and the observation. It was useful in these groups of patients as were the determinations of the basal metabolic rate, the protein-bound I or the maximum uptake of I^{131} in the thyroid. By study of the uptake curve up to 7 hr the per cent per hour was found to be markedly dependent upon the time at which the observations were made. As a consequence, if the value of the per cent per hour is compared only with those taken at similar times, it is even more useful. Similarly, the absolute value of the uptake determined at any particular time between 2 and 7 hr is of use in differentiating patients with hyperthyroidism from those without hyperthyroidism. The results of the tests are unpredictable in patients with nodular goiters and colloid goiters. (auth)

954

University of California Radiation Laboratory
INFLUENCE OF TUMORS ON THE LIVER CONCENTRATION OF RADIOACTIVE STILBAMIDINE. John C. Weaver, Bert M. Tolbert, and Barbara J. Kreuckel. Oct. 23, 1950. 10p. (UCRL-963)

A series of normal and tumorous mice were injected with stilbamidineamidine-C_2^{14}. After 96 hr, the livers were removed and analyzed for radioactivity. Much higher and distinctly abnormal concentrations of C^{14} were found in the tumor-bearing A and dba strain mice as compared to the controls. Some data for C57, Bagg, and McDonnel strain mice are also given. The relation of this phenomenon to possible abnormalities in nucleic acid concentration in tumor-bearing mice is discussed. (auth)

955

BLOOD LEVELS OF I^{131} AFTER TRACER DOSES IN THE DIAGNOSIS OF HYPERTHYROIDISM. Solomon Silver and Mack H. Fieber. Proc. Soc. Exptl. Biol. Med. 75, 570-3 (1950) Nov.

By prolonging the study of blood levels after tracer doses of I^{131} to 96 hr, secretion of thyroid hormone into the circulation rather than concentration and fixation by the thyroid gland has been measured. This appears to be the best method presently available for clinical use in the diagnosis of hyperthyroidism. A single blood or plasma sample of 1 cc gives diagnostic values when counted after air drying. The determination of the protein-bound fraction only very rarely gives additional information but can be used to exclude spurious high levels as are occasionally found in cases of renal insufficiency where excretion of the circulating inorganic I^{131} is delayed. (auth)

956

THE FATE OF SOME INTRAVENOUSLY INJECTED ZINC COMPOUNDS. 1. THE DETERMINATION OF ^{65}Zn IN TISSUES. 2. THE FATE OF INJECTED ZINC CARBONATE AND PHOSPHATE AND A ZINC DITHIZONE COMPLEX. T. E. Banks, R. L. F. Tupper, and A. Wormall. Biochem. J. 47, 466-72(1950) Oct.

A step-by-step method for the determination of Zn^{65} in animal tissues is described. This method is a modification of one employed by Gettler and Bastian (Am. J. Clin. Path. 17, 244(1947)), and consists basically of a selective extraction of the zinc from aqueous solution by dithizone at pH 8.5 to 9.0 and subsequent radiometric analysis. The recovery of added Zn^{65} is usually 95 to 100%. A study has been made of the distribution of radioactive zinc in the tissues of rabbits following the intravenous injection of Zn^{65}-containing zinc carbonate or phosphate or a zinc dithizone complex.

957

Lankenau Hospital Research Institute and Temple University
INCORPORATION OF GLYCINE CARBON INTO YEAST LIPIDES. Sidney Weinhouse, Ruth H. Millington, and Murray Strassman. [nd.] 13p. (NP-1831)

Fatty acids isolated from yeast grown in the presence of methylene-C^{14}-labeled glycine had a high content of C^{14}, distributed equally among all carbons of the chain. Fatty acids isolated from yeast grown in the presence of carboxyl-labeled glycine had negligible activity. These results suggest that fatty acids are formed from glycine

through the steps serine, pyruvate, and acetate. Glycine α-carbon activity was found also in the unsaponifiable matter, and in the methyl carbons of choline. (auth)

958

INFLUENCE OF AGE, SEX, AND SEASON UPON RADIOIODINE UPTAKE BY THE HUMAN THYROID. Edith H. Quimby, Sidney C. Werner, and Charlotte Schmidt. Proc. Soc. Exptl. Biol. Med. 75, 537-40(1950) Nov.

The percentage of a tracer dose of radioiodine deposited in the thyroid gland at the end of 24 hr was determined by measurement of radioactivity directly over the gland in 1050 tests in apparently euthyroid individuals. It is concluded that, within the New York area, there is statistically no effect of season on the average uptake of radioiodine by the thyroid gland of the euthyroid individual. The 24-hr uptake of radioiodine decreases progressively but slightly with each decade of age. The extent of fall is statistically, but not clinically, significant. Women in all age groups show a slightly higher average uptake than men. The difference is not clinically significant. (auth)

959

IN VIVO LOCALIZATION OF RADIOACTIVE SILVER AT PREDETERMINED SITES IN TISSUES. PRELIMINARY REPORT. Harold D. West, Raven Rivera Elliott, Alphonso P. Johnson, and Charles W. Johnson. Am. J. Roentgenol. Radium Therapy 64, 831-4(1950) Nov.

Radioactive silver, Ag^{110}, was injected into rats and was shown to localize at the site of spontaneous or Staphylococcus aureus induced infections. A possible explanation of the phenomenon consists in the theory that the silver, being transported by white blood cells, concentrates in these areas as a result of phagocytosis.

CHEMISTRY

960

Iowa State College Ames Laboratory
ON THE EXISTENCE AND RELATIVE STABILITY OF HAFNIUM PEROXIDE; CONTRIBUTION NO. 134. Frederick R. Duke and Robert F. Bremer. [nd.] 3p. (AECU-1101)

A set of experiments and the data obtained from them indicate not only that hafnium peroxide exists, but that it has almost exactly the same solubility and stability toward decomposition into the hydrous oxide and oxygen as does zirconium peroxide.

961

Sylvania Electric Products, Inc.
THE DECOMPOSITION COEFFICIENT OF ZIRCONIUM TETRAIODIDE. (abstract) R. B. Holden and Bernard Kopelman. [nd.] 1p. (AECU-1115; SEP-45)

The report is reproduced here in its entirety.

A new type of measurement is described which allows the measurement of the decomposition coefficient of zirconium tetraiodide. This coefficient is defined as the probability that a particular zirconium tetraiodide molecule will decompose upon impinging once upon a hot surface in vacuo. The apparatus and procedure used in measuring this coefficient as a function of temperature are described. The apparatus consists of a hot target confronted by an orifice, both in a vacuum of the order of 3×10^{-7} mm Hg. A known quantity of zirconium tetraiodide is effused through the orifice under essentially equilibrium conditions. The fraction which actually strikes the target is calculated from the geometry of the apparatus with the aid of Knudsen's Law, and the actual quantity of zirconium deposited upon this target is measured chemically. The walls which surround the target and orifice are refrigerated with liquid nitrogen in order to trap out the undecomposed zirconium tetraiodide plus the gaseous decomposition products. The experimentally determined values for the decomposition coefficient, γ_c, lie between 0.5 and 1.0 in the temperature range 1211 to 1432°C. The decomposition coefficient is closely related to the thermal accommodation coefficient, the relaxation times for the vibrational modes of the zirconium tetraiodide molecule, the average time which molecules spend absorbed upon the surface, and the actual energy required to rupture the various zirconium-iodine bonds.

962

Carnegie Institute of Technology
PROGRESS REPORT FOR JUNE AND SEPTEMBER 1950. Carl Moore, D. S. McKinney, and J. C. Warner. Dec. 10, 1950. 8p. (NYO-545)

Experimental work and data are presented for the cathodic polarization characteristics of Ti and Zr in H_2SO_4. Experimental procedure, methods of analysis, and pH determination are reported for the determination of the solubility of ZnO as a function of temperature and pH. (auth)

963

Oak Ridge National Laboratory
TANTALUM PHOSPHATE; A NEW COMPOUND. Richard B. Hahn. Dec. 13, 1950. 6p. (ORNL-841)

A known amount of tantalum pentoxide in the form of potassium tantalate was treated with an excess of phosphoric acid and nitric acid. The mixture was digested 30 to 60 min in a hot water bath, and the resulting precipitate was quantitatively transferred to a filter and washed with a cold 1:1 acetone-water mixture until the excess phosphoric acid was eliminated. The washed precipitate was ignited at 1000°C and weighed. The composition was found to be Ta_2O_5, 75.5 ± 0.2%, and P_2O_5, 24.5 ± 0.2%. The composition calculated for $Ta_2O_5 \cdot P_2O_5$ was Ta_2O_5, 75.68%, and P_2O_5, 24.32%. X-ray-diffraction data are given. The solution obtained from the fusion of the compound with sodium hydroxide was found to contain orthophosphate ions. Hence $TaOPO_4$ is considered the most probable formula.

964

Pennsylvania State College
STUDIES ON THE ZIRCONIUM DERIVATIVES OF β-DIKE-

TONES. Fred A. Snavely and W. Conard Fernelius. July 1950. 38p. (PSC-2)

An investigation undertaken to prepare the Zr derivatives of several β-diketones and to test their volatility is reported. The behavior of each β-diketone in alkaline titration was studied. From a simple titration of the β-diketone itself, the acid dissociation constant of material can be estimated. From a titration of the zirconyl ion in the presence of the β-diketone the formation constant of the chelate compound can be estimated.

965

University of Illinois
COMPARATIVE STUDIES ON GALLIUM CHEMISTRY; FINAL REPORT. Therald Moeller, Alvin J. Cohen, Glendall L. King, and Fred L. Pundsack. Sept. 30, 1950. 70p. (NP-1768)

Extensive studies on the 8-quinolinol and 5,7-dihalo-8-quinolinol chelates of gallium, particularly with respect to extraction and absorption-spectra measurements, are reported. These studies are in addition to those reported in NP-1011 (see NSA 3-1534) and NP-1233 (see NSA 4-1044). 18 figures.

966

AN IRREGULARITY IN THE SOLVENT POWERS OF PARAFFINS. Joel H. Hildebrand. J. Chem. Phys. 18, 1337-8 (1950) Oct.

The solubility relations of n-heptane with perfluoroheptane, iodine, sulfur, stannic iodide, and phosphorus are all accounted for within the usual limits of accuracy for regular solution theory by a solubility parameter 8.1 instead of the value 7.45 derived from its energy of vaporization per cubic centimeter. Solutions of 2,2,4-trimethylpentane with perfluoroheptane and with iodine are similarly accounted for by the empirical value 7.45 instead of 6.85. Such an adjustment for paraffins is a practical alternative to the treatment used by Simons and Dunlap (J. Chem. Phys. 18, 335(1950)), for the system n-pentane, "pentforane," which they recently reported upon, and is, at the same time, consistent with their assumption that the exceptional behavior of paraffins is to be attributed to an irregularity in their mutual repulsions. (auth)

ANALYTICAL PROCEDURES

967

Department of Mines and Technical Surveys, Mines Branch, Ottawa
THE CHEMICAL DETERMINATION OF THORIUM IN ITS ORES. John C. Ingles. Oct. 3, 1950. 27p. (NP-1884; TR-62/50)

The chemical determination of Th in ores is complicated by the similarity of its properties to those of many other elements. A large number of separational procedures are available, and the present paper compares the efficiency of a number of these methods. An integrated chemical procedure, combining those separations which appeared most reliable, is presented. (auth)

968

DETECTION OF VANADIUM BY MEANS OF SPOT TESTS. Philip W. West and Louis J. Conrad. Mikrochemie ver. Microchim. Acta 35, 443-8(1950) Oct.

Two spot tests for vanadium were developed. One test involves the use of α-benzoinoxime as the reagent, and the other employs α,α -dipyridyl or orthophenanthroline. Detailed interference studies were made on reported tests for detecting vanadium which use dimethylglyoxime and sodium tungstate as reagents. Improvements were made in the dimethylglyoxime test by adding disodium phosphate which prevents the precipitation of a number of ammoniacal insoluble ions and ferric iron which is used in the test procedure. This greatly simplifies the interpretation of the results and makes it possible to carry out the test in a spot plate. 14 references. (auth)

969

Department of Mines and Technical Surveys, Mines Branch, Ottawa
DETERMINATION OF URANIUM IN ORES; REVIEW OF CHEMICAL METHODS; MEMORANDUM SERIES NO. 109. F. T. Rabbitts. Sept. 1950. 13p. (NP-1890)

Four methods are outlined in detail. The typical textbook method is of historical interest only. The mercury cathode-cupferron method, was formerly used in the Mines Branch but has now been replaced by the cellulose column and microfluorimetric methods.

970

ESTIMATION OF BROMIDES BY AN ACTIVATION-EXCHANGE METHOD. F. P. W. Winteringham. Analyst 75, 627-8(1950) Nov. (Note)

Activation analysis is greatly facilitated if the radioisotope to to be determined will exchange with an added, easily separated compound. An experimental procedure for the determination of as little as 10^{-8} g of bromine in the presence of any amount of the other halides by Br^{82} exchange with methyl bromide dissolved in acetone is presented. The gaseous methyl bromide may be drawn off after the exchange has taken place. Typical counting equipment permits a determination to within a few per cent.

971

INCLUSION OF THE LESS FAMILIAR ELEMENTS IN A SMALL-SCALE NON-H_2S SCHEME OF ANALYSIS. Hamed El-Badry, Francis R. M. McDonnell, and Cecil L. Wilson. Anal. Chim. Acta 4, 440-52(1950) Oct.

A recognized non-H_2S scheme for the separation and identification of the so-called "common" metallic elements has been extended so as to be applicable to materials containing the following elements: cerium, molybdenum, thorium, titanium, tungsten, uranium, vanadium, and zirconium. (auth)

972

MICROEFFUSIOMETRY OF GASEOUS MIXTURES. Frank E. Harris and Leonard K. Nash. Anal. Chem. 18, 1552-6 (1950) Dec.

The true molecular effusion of pure gases is very accurately described by Graham's law. However, the analysis

of gaseous mixtures in terms of their relative rates of molecular effusion is seriously hindered by the partial separation of components that characterizes such effusion. The progressive alterations in composition that are so produced vitiate the direct application of Graham's law to the bulk of the mixture. This difficulty can be overcome by the separate application of Graham's law to each of the components of the effusing mixture. This method also creates the new possibility of obtaining from effusiometric work the complete quantitative analysis of mixtures containing more than two constituents. In addition, qualitative data can be obtained by this means. A very simple apparatus and technique for the microeffusiometric examination of mixtures of gases are described, and the broad capabilities of this method are illustrated by a number of experimental results.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

973

Los Alamos Scientific Laboratory
OPTICAL CRYSTALLOGRAPHY OF URANIUM COMPOUNDS. Eugene Staritzky and A. L. Truitt. Mar. 16, 1950. Decl. Dec. 8, 1950. 30p. (AECD-3017; LA-1081; LADC-873)

Optical and morphological characteristics of the following uranium compounds have been compiled or determined: uranium trichloride, uranium tetrafluoride, di-(tetramethylammonium) uranium hexachloride, uranium disulfate tetrahydrate, uranium dioxalate hexahydrate, uranyl dichloride monohydrate, uranyl monobasic trichloride dihydrate, acid uranyl chloride dihydrate, dicesium uranyl tetrachloride, di-(tetramethylammonium) uranyl tetrachloride, uranyl dinitrate hexahydrate, uranyl dinitrate trihydrate, ammonium uranyl trinitrate, diammonium uranyl tetranitrate, diammonium uranyl tetranitrate dihydrate, uranyl sulfate dihydrate, uranyl sulfate trihydrate, acid diuranyl trisulfate pentahydrate, diammonium diuranyl trisulfate pentahydrate, diammonium uranyl disulfate dihydrate, uranyl diacetate dihydrate, and uranyl oxalate trihydrate. 18 photomicrographs.

DEUTERIUM AND DEUTERIUM COMPOUNDS

974

DETERMINATION OF HEAVY WATER BY MASS SPECTROMETER. B. W. Thomas. Anal. Chem. 22, 1476-8(1950) Dec.

A procedure employing the mass spectrometer has been developed for the rapid analysis of aqueous samples containing low concentrations of heavy water in water. The aqueous liquid mixtures are introduced directly into the mass-spectrometer vacuum system, and the analysis is based on the relative abundances of mass 19 from DOH and mass 18 from HOH. Calibration data are obtained from known mixtures covering the desired range of heavy water in water. The method appears to be accurate to ±0.2% in the range of 0.2 to 1% and to ±0.3% in the range of 1 to 10% D_2O. Instrument- and calculation-time requirements are 15 to 20 min per analysis. (auth)

975

ISOTOPE EXCHANGE REACTION OF CHLOROFORM-d WITH BROMOFORM. George P. Semeluk and Richard B. Bernstein. J. Am. Chem. Soc. 72, 4830-1(1950) Oct. (Note)

An infrared spectrophotometric investigation of the deuterium exchange reaction $CCl_3D + CBr_3H \rightleftharpoons CCl_3H + CBr_3D$ has been made. The results appear to lend support to an ionic mechanism for the exchange.

976

THE PREPARATION OF HIGH-PURITY HYDROGEN DEUTERIDE. A. Fookson, P. Pomerantz, and E. H. Rich. Science 112, 748-9(1950) Dec. 22. (Technical paper)

Hydrogen deuteride 99% pure was obtained when $LiAlH_4$ was decomposed with D_2O at 0°C. The product of this reaction was then fractionated at liquid hydrogen temperature.

FLUORINE AND FLUORINE COMPOUNDS

977

EVALUATION OF FLUORINE COMPOUNDS FOR USE IN MILITARY AIRCRAFT. J. C. Mosteller and E. M. Glass. Tech. Data Dig. 15, No. 12, 22-9(1950) Dec.

Some of the evaluation studies conducted by and for the Air Force in the field of fluorine chemistry in order to review both the desirable properties and the limitations of these materials are reported. Their potential uses have been examined as heat-transfer media, fire-extinguishing agents, electrical-component materials, rubberlike materials, and nonflammable hydraulic fluids and lubricants.

978

California Institute of Technology Jet Propulsion Laboratory
THE PROPERTIES OF FLUORINE, OXYGEN BIFLUORIDE, AND CHLORINE TRIFLUORIDE; MEMORANDUM NO. 9-16. Russell N. Doescher. Sept. 6, 1949. 69p. (NP-1770)

Compilation of properties; notes on handling; reactions; purification; liquefaction; instrumentation in handling; physical properties; thermodynamic properties; corrosion of various substances; 38 tables; 90 references.

979

RAPID TEST FOR FLUORIDE ION. W. R. Crandall. Anal. Chem. 22, 1449-50(1950) Nov.

A qualitative test based on a known reaction of alkali fluorides with hydrated alumina, which was originally devised to control the sodium fluoride concentration in industrial casein solutions, has been found to be generally applicable and responsive to one drop of 0.01% sodium fluoride solution, or its fluoride equivalent, without interference by sodium caseinate or low concentrations of the more common anions, except oxalate ion.

980

TRIS-(m-TRIFLUOROMETHYLPHENYL)-FLUOROSILANE AND TETRAKIS-(m-TRIFLUOROMETHYLPHENYL)-SI-

LANE. H. Harry Szmant and Joseph F. Anzenberger. J. Am. Chem. Soc. 72, 5346(1950) Nov. (New compounds)

The methods of preparation of the new compounds $C_{21}H_{12}F_{10}Si$ and $C_{28}H_{16}F_{12}Si$, from silicone tetrafluoride and m-trifluoromethylphenylmagnesium bromide, are briefly presented.

GRAPHITE

981

THE INTERPRETATION OF DIFFUSE X-RAY DIAGRAMS OF CARBON. Rosalind E. Franklin. Acta Cryst. 3, 107-21 (1950) Mar.

Measurements on a carbon prepared by pyrolysis of polyvinylidene chloride at 1000°C have been used to study methods of interpretation of the diffuse x-ray diagrams given by nongraphitic carbons. Results obtained from a Fourier integral analysis are in satisfactory agreement with those deduced from a comparison of the experimental intensity curve with an intensity curve calculated for a hypothetical structure. For the high-angle part of the diagram the latter method is found to be preferable; it is less tedious and gives the results with greater precision. The Fourier transform of the low-angle scattering is, however, of value. It is concluded that, in the carbon investigated, 65% is in the form of highly perfect and planar graphitelike layers of mean diameter 16 A, and 35% is in a much less organized state, giving only a gaslike contribution to the x-ray scattering. About 55% of the graphitelike layers are grouped in pairs of parallel layers with an interlayer spacing of 3.7 A, and the remaining 45% show no mutual orientation. There is a mean interparticle distance of about 26 A. (auth)

LABORATORIES AND EQUIPMENT

982

University of California Radiation Laboratory
THE USE OF LABORATORY HIGH FREQUENCY INDUCTION FURNACES. Leo Brewer. Apr. 3, 1950. 42p. (UCRL-653)

Equations are derived for the rates of heating of objects in induction furnaces and for the maximum temperatures attainable. The equations are primarily useful in designing conducting crucibles, shells, and cylinders so as to increase the power input and decrease heat losses. A brief treatment is given of the factors which influence the current in the induction coil. The performances of various induction furnaces are compared. (auth)

983

Atomic Energy Research Establishment
A MINIATURE HOT PLATE AND RADIANT HEAT DRYER. F. Hudswell and K. L. Wilkinson. Oct. 1950. 4p. (AERE-C/R-599)

A small-scale radiant hot plate for use in a dry box or in any application where an ordinary hot plate or heat lamp would give too intense heat is described.

RADIATION EFFECTS

984

University of Chicago Metallurgical Laboratory
RADIATION CHEMISTRY; THE CHEMICAL EFFECTS OF RADIATION ON MATTER; TRAINING PROGRAM LECTURE NOTES. Milton Burton. May 3, 1943. Decl. Sept. 19, 1950. 10p. (AECD-2977)

The reactions in U, Al, steel, water, and hydrogenous materials caused by the fission recoils, neutrons, neutrinos, β particles, γ radiation, and α particles produced in a nuclear reactor are discussed briefly. The mechanism of absorption reactions, calculation of the ion-pair yield, and some typical studies and results on water and organic materials are summarized.

985

National Research Laboratories, Ottawa
DISSOCIATION OF MOLECULES BY THE ACTION OF LIGHT; trans. from Uspekhi Fiz. Nauk 36, 292-307(1948) Nov. A. N. Terenin; tr. by Esther Rabkin. Mar. 18, 1950. 34p. (TT-128)

A general discussion of recent work on the photodecomposition of molecules is presented. The disadvantages of the manometric and selective indicator methods of investigating photoreacions are mentioned, followed by special attention to the direct observation of the luminescent particles from photodissociation. Selective action of light, kinetic energy of the particles, and ionization in photochemical reactions are among the related problems considered.

RARE EARTHS AND RARE-EARTH COMPOUNDS

986

THE RARE EARTHS. SEPARATIVE EXTRACTION OF CERTAIN RARE EARTH ELEMENTS AS 5,7-DICHLORO-8-QUINOLINOL CHELATES. Therald Moeller and Dale E. Jackson. Anal. Chem. 22, 1393-7(1950) Nov.

Although the 8-quinolinol chelates of the tripositive rare-earth elements are not quantitatively extracted into chloroform, extraction of the corresponding 5,7-dichloro-8-quinolinol chelates is complete in controlled pH ranges. Extraction of Nd and Er above pH values of 9.4 and 8.3, respectively, shows extraction to be favored by decreased basicity in the rare-earth-metal ion. Overlaps in the extraction ranges of these two ions indicate that separations among the rare-earth elements through extraction of the 5,7-dichloro-8-quinolinol chelates at controlled pH are only fractional in character. Spectrophotometric studies on chloroform solutions of the Nd and Er chelates show broad chelate absorptions centering around 4000 A, with sharp, characteristic rare-earth absorptions at longer wavelengths. Bands at 5740, 5818, and 5872 A for Nd and at 5208 and 5245 A for Er are of particular importance. Nd absorption at 5818 A and Er absorption at 5208 A obey Beer's law in the concentration range 10^{-4}M and are more intense than corresponding absorptions in aqueous solution. Spectrophotometric determination of Nd in the presence of neighboring rare-earth elements is feasible at lower concentrations than in aqueous solutions. (auth)

SEPARATION PROCEDURES

987

Iowa State College
THE SEPARATION OF THE RARE EARTHS BY ION EXCHANGE. Elroy M. Gladrow. 1948. 147p. (AECD-2991)

This research was designed to obtain a set of standard conditions for a high-yield, short-time separation on Amberlite IR-1 at room temperatures with ammoniated citric acid as the eluant, for the purpose of obtaining macro quantities of pure rare earths (the lanthanides, yttrium, and scandium). The effects of pH, column length and diameter, flow rate, and composition of the starting material have been studied by tracer techniques. Elution curves for various rare-earth separations are shown. The mechanism of the separation, relation to ion size and basicity, and experimental difficulties are discussed.

988

Stanford Research Institute
MONTHLY PROGRESS REPORT NO. 1; CONTINUOUS SEPARATION OF IONS BY USING A MOVING ION EXCHANGE BED; S.R.I. PROJECT NO. CU-337. Nevin K. Hiester. July 1950. 3p. (AECU-1110; MPR-1)

This is the first report describing the program for and progress on a fundamental study of the variables effecting continuous ion separation by ion-exchange resins. A set of preliminary batchwise adsorption runs was made to determine the equilibrium constants of both Li and K between acid solutions containing various mixtures of the ions and each of four resins in hydrogen form. It is indicated that Duolite C-20, a bead-type polystyrene resin containing nuclear sulfonic acid groups, would be satisfactory for the future continuous runs.

989

Stanford Research Institute
MONTHLY PROGRESS REPORT NO. 2; CONTINUOUS SEPARATION OF IONS BY USING A MOVING ION EXCHANGE BED; S.R.I. PROJECT NO. CU-337. Nevin K. Hiester. Aug. 1950. 2p. (COO-26; MPR-2)

Further progress on a fundamental study of the variables affecting continuous ion separation by the use of moving ion exchange resins is briefly reported.

990

Oak Ridge National Laboratory
ANION EXCHANGE STUDIES; III. PROTACTINIUM IN SOME HCl-HF MIXTURES; SEPARATION OF NIOBIUM, TANTALUM, AND PROTACTINIUM. Kurt A. Kraus and George E. Moore. Nov. 13, 1950. 11p. (ORNL-673)

The anion-exchange behavior of Pa in HCl-HF mixtures has been studied and a number of conditions were found under which this element can be adsorbed. Since its adsorbability differs widely from that of Nb and Ta, excellent separation of this triad can be achieved under a variety of conditions. (auth)

991

University of California Radiation Laboratory
CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS; XIV. PREPARATION AND ISOLATION OF $Bi^{204,205}$ FROM LEAD. Jeanne D. Gile, Warren M. Garrison, and Joseph G. Hamilton. Nov. 21, 1950. 4p. (UCRL-1017)

The report is reproduced here in its entirety.

A carrier-free procedure used in isolating radiobismuth from a Pb target which had been bombarded with 19-Mev deuterons in the 60-in. cyclotron at Crocker Laboratory is reported. Deuteron bombardment of Pb produces $Bi^{204,205}$ by the nuclear reactions $Pb^{204}(d,2n)Bi^{204}$, $Pb^{205}(d,2n)Bi^{205}$ (Seaborg and Perlman, Revs. Modern Phys. 20, 185(1948); Templeton et al., Phys. Rev. 72, 766(1947)). Other possible concurrent reactions include formation of radiolead isotopes by (d,p) reaction, radioisotopes of Tl by (n,p) reaction, and radioisotopes of Hg by (n,α) reaction. The short-lived Tl activities, $Tl^{205,207,208}$, had decayed out prior to the chemical separation reported here. The long-lived Tl^{204} and Hg^{203} were not detected. The target was spectrographically pure (bismuth was not detected by spectrographic analysis) lead foil (⅛-in. thick) clamped to a water-cooled Al target plate. It was bombarded with 19-Mev deuterons for a total of 20 μa-hr at a maximum beam intensity of 5 μa. Higher bombardment intensities would have melted the target. After bombardment, the foil (approximately 1 g) was dissolved in a minimum volume of 16N HNO_3 and the resultant solution was evaporated to dryness. The $Pb(NO_3)_2$ containing the carrier-free $Bi^{204,205}$ was dissolved in excess 10% NaOH to give a clear "solution" of sodium plumbate and radiocolloidal $Bi^{204,205}$. This solution, after dilution with an equal volume of water, was drawn through two consecutive Whatman No. 50 filter papers which retained more than 98% of the carrier-free $Bi^{204,205}$ as absorbed radiocolloid. The filters were washed with 5% NaOH until Pb could not be detected in the filtrate, followed by distilled water to remove NaOH. Less than 1% of Bi activity was removed from the filter paper during the washing. The $Bi^{204,205}$ was removed from the filter paper with a minimum amount of 6N HCl which, after a reduction in volume by evaporation, was neutralized with NaOH to give an isotonic saline solution for biological investigation. The decay curve was followed for 30 days and showed two periods: 12-hr Bi^{204} and 6.4-day Bi^{205}. Forty hours after bombardment, the activity contained only 6.4-day Bi^{205}. The Pb absorption curve showed the 1.1-Mev γ ray and the softer component (approximately 0.4 Mev) previously reported(Templeton et al., loc. cit.). The Al absorption curve had an end point of approximately 300 mg, a somewhat lower value than that previously given. The activity was further identified by chemical separation using Bi, Pb, Tl, and Hg carriers. More than 99% of the added tracer activity was recovered in the bismuth fraction.

992

University of California Radiation Laboratory
CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS: XV. PREPARATION AND ISOLATION OF Mn^{52} FROM CHROMIUM. Herman R. Haymond, Warren M. Garrison, and Joseph G. Hamilton. Dec. 4, 1950. 2p. (UCRL-1033)

The report is reproduced here in its entirety.

Deuteron bombardment of Cr produces three radioisotopes of Mn (46-min Mn^{51}, 6.5-day and 21-min Mn^{52}, and 310-day Mn^{54}) by (d,n) and (d,2n) reaction (Seaborg and Perlman, Revs. Modern Phys. 20, 585(1948)). This paper describes a radiochemical procedure used in isolating carrier-free

radiomanganese (6.5-day Mn^{52}) from a Cr target which had been bombarded with 19-Mev deuterons in the 60-in. cyclotron at Crocker Laboratory. The Mn^{51} and Mn^{52m} had decayed out prior to chemical separation. The 310-day period of Mn^{54} was not observed, presumably due to the low abundance of $Cr^{53,54}$. Other possible concurrent reactions include the formation of radiovanadium by (d,α) reaction and radiotitanium by (d,αp) reaction. A quantitative separation from V is obtained with the procedure described here. Radiotitanium, Ti^{51}, was not detected. Spectrographically pure chromium powder (manganese was not detected by spectrographic analysis), supported on a water-cooled aluminum target plate by 0.25-mil Pt foil, was bombarded for 20 μa-hr at a beam intensity of 10 μa. After bombardment, the Cr powder (approximately 1 g) was dissolved in a minimum volume of 12N HCl, and the resultant solution was evaporated to incipient dryness. Ferric chloride in the amount of 20 mg was added, and the chromic chloride containing the carrier-free radiomanganese was redissolved in 50 ml of 1N HCl. This solution was then added with stirring to 200 ml of 2.5N NaOH solution previously saturated with bromine. Under these conditions, the carrier-free radiomanganese, presumably in the tetrapositive state, is quantitatively carried on the ferric hydroxide precipitate (Maxwell, Gile, Garrison, and Hamilton, J. Chem. Phys. 17, 1340(1949)). Cr and V are retained in the supernatant. Two additional reprecipitations were made to insure complete separation. The ferric hydroxide was washed, dissolved in 6N HCl and Fe was extracted with ethyl ether. The solution of carrier-free radiomanganese in 6N HCl was evaporated to dryness after the addition of 5 ml of isotonic saline solution. The activity dissolved quantitatively with the addition of 5 ml of water. The decay curve was followed for eight half lives and showed a single period of 6.2 days which agrees closely with the reported value for Mn^{52} (Livingood and Seaborg, Phys. Rev. 54, 391(1938)). Absorption measurements in Al showed the assigned (Peacock and Deutsch, Phys. Rev. 69, 306(1946)) 0.6-Mev positron. The activity was further identified by chemical separations using Mn, Cr, V, and Ti carriers. More than 99% of a sample of the activity was recovered in the Mn fraction.

993

University of Kansas
PHYSICO-CHEMICAL INVESTIGATION OF ION EXCHANGERS. Arthur W. Davidson, William J. Argersinger, Jr., Warren K. Lowen, Raymond W. Stoenner, and Oscar D. Bonner. [nd.] 92p. (NP-1668)

Eight exchange systems involving the ions Na^+, H^+, NH_4^+, Ag^+, Tl^+, Ni^{++}, and Ca^{++} have been investigated, with Dowex 50 as exchanger and in solutions of constant total ionic strength of approximately unity. The equilibrium constant values are reported as functions of the equilibrium exchanger composition. Equivalence of exchange as ordinarily understood is apparently not obtained in these systems. In certain systems, particularly those involving either silver or thallous ion, adsorption of the exchanging electrolyte by the solid resin is observed. In all exchange systems studied, the apparent equilibrium constant is found to vary regularly with equilibrium resin composition. It is concluded that the usual assumption of ideal solid solution behavior in the exchanger phase must be invalid. Three exchange systems involving H^+, NH_4^+, and Ag^+ ions were restudied in an attempt to determine the reason for some of the anomalies. It was found that the apparent nonequivalence of exchange is due to the following factors: (1) absorption or desorption of water by the resin; (2) adsorption of ions on the resin; and (3) change in volume of the solution due to exchange of electrolytes of differing partial molal volumes. The equilibrium water absorption is found to be a linear function of resin composition, independent of the initial water content of the resin. A new method has been devised for the determination by graphical means of the resin-phase activity coefficients and the true thermodynamic equilibrium constant in an exchange system, and this method has been applied to the Na-H exchange data. When equilibrium constants are calculated by the methods here described, no appreciable hysteretic effects are observed.

994

ROLE OF EXTRACTION IN ANALYTICAL CHEMISTRY. George H. Morrison. Anal. Chem. 22, 1388-93(1950) Nov.

Analytical liquid-liquid extractions fall largely into three classes: inorganic, organometallic, and organic. Laboratory apparatus and general techniques, including batch and continuous procedures, are reviewed. Many inorganic extractions are dependent on the formation of undissociated complex acids which are soluble in organic solvents. The salting-out effect produced by the presence of cations plays an important role in extraction; in general, the cations of higher valency are more effective. Several simplified theoretical relationships concerning organometallic extractions are presented, which emphasize the importance of pH and concentration of reagent in metal extraction. Improved countercurrent distribution instruments permit separation or estimation of closely related organic substances and are applicable to many complex organic or biochemical problems. 38 references. (auth)

SPECTROSCOPY

995

CHEMICAL ANALYSIS WITH THE AID OF X RAYS. L. Rivoir Alvarez. Anales fís. y quím. (Madrid) 46A, 77-82(1950) Mar.-Apr. (In Spanish)

Quantitative determinations of elements in mixtures can be made by measuring relative darkening intensities on x-ray spectrograms, the radiation energy being proportional to the number of atoms in the active layer of the anticathode.

SYNTHESES

996

Brookhaven National Laboratory
SIMPLE PREPARATION OF OPTICALLY ACTIVE SECONDARY ALCOHOLS. Aksel A. Bothner-By. [nd.] 3p. (AECU-1072)

A detailed description is given of the synthesis of optically active sec-butyl alcohol by the reduction of methyl ethyl ketone with lithium aluminum hydride which has been partially reacted with d-camphor. Properties of alcohols obtained by similar optically asymmetric reductions of pinacolone are listed.

997

C^{14} LABELED 4(5)-AMINO-5(4)-IMIDAZOLECARBOXAMIDE IN THE BIOSYNTHESIS OF PURINES. C. S. Miller, S. Gurin, and D. W. Wilson. Science 112, 654-5(1950) Dec. 1. (Technical paper)

As a part of a general program to study the biosynthesis of purines from labeled precursors, a convenient synthesis of 4(5)-amino-5(4)-imidazolecarboxamide containing C^{14} in the 4(5) position is reported. Results of subcutaneous injection of the hydrochloride in rats are included.

998

SYNTHESIS OF ANTHRACENE-9-C^{14}. William H. Stevens and D. Alma Holland. Science 112, 718-19(1950) Dec. 15. (Technical paper)

The synthesis, starting with the preparation of o-toluic acid-carbonyl-C^{14} by carbonating a twofold excess of Grignard reagent obtained from o-bromotoluene with 10 millimoles of CO_2 containing 2 mc of C^{14}, is given in detail. Final yield was 1.3 g of anthracene having an activity of 0.9 μc/mg.

999

THE SYNTHESIS OF RADIOACTIVE dl-HISTIDINE(C^{14}OOH) L.-P. Bouthillier and A. D'Iorio. Rev. can. biol. 9, 382-7 (1950) Nov. (In French)

Ethyl cyanoacetate has been synthesized by reaction of ethyl chloroacetate with C^{14}-labeled sodium cyanide. Radioactive ethyl acetamido cyanoacetate was obtained by nitrosation of ethyl cyanoacetate and reduction of the isonitroso derivative. By condensation of ethyl acetamido cyano(C^{14}) acetate with 4-chloromethyl imidazole and hydrolysis of the product, dl-histidine(C^{14}OOH), with a radioactivity of 1755 cpm/mg was obtained. The over-all yield in radioactive histidine, calculated on the basis of the amount of $NaC^{14}N$ used, was found to be 6%. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

1000

University of California Radiation Laboratory
THE PREPARATION AND SOME PROPERTIES OF AMERICIUM METAL. Edgar F. Westrum, Jr., and LeRoy Eyring. Aug. 1950. Decl. Sept. 5, 1950. 13p. (AECD-2980; ANL-EFW-37; PC-1235)

Results of experimental work to determine the properties of americium (with reference to the hypothesis that the seventh period elements form a 5f series of the actinide type) are reported. Americium is indicated as occupying a homologous position to that of europium which is a metal of abnormally low density compared to its lanthanide neighbors. Using highly purified aqueous nitrate stock solutions of americium, the preparation of americium trifluoride based on hydrofluorination of the hydroxide, preparation of the metal by reduction of the trifluoride with barium in a BeO crucible, and preparation of americium hydride based on the subjection of the metal to hydrogen gas at 50°C are described. Attempts to determine the density, the melting point, and the heat of solution are also described. 22 references.

1001

ON THE COPRECIPITATION OF TETRAPOSITIVE IONS WITH LANTHANUM FLUORIDE. Kurt Schlyter and Lars Gunnar Sillén. Acta Chem. Scand. 4, No. 8, 1323-4(1950) (Short communication)

Coprecipitation of tetrapositive plutonium with lanthanum trifluoride is explained as the formation of solid solutions consisting of anomalous mixed crystals. X-ray diffraction studies of precipitates from $Ce^{+4}-La^{+3}$ and $U^{+4}-La^{+3}$ solutions lead to the conclusion that the Ce^{+4} and U^{+4} are actually contained in the LaF_3 lattice. By analogy, Pu^{+4} with a radius similar to those of Ce^{+4} and U^{+4} should act in the same way.

URANIUM AND URANIUM COMPOUNDS

1002

COMPARISON OF LUMINESCENCE SPECTRA OF CRYSTALS AND SOLUTIONS OF URANYL SULFATE. B. E. Gordon. Doklady Akad. Nauk S.S.S.R. 74, 913-16(1950) Oct. 11. (In Russian)

When the attraction between molecules of the solute exceeds that between them and the solvent, there is a tendency toward the formation of unstable aggregates, or "microcrystals," of the solute. Such a "microcrystallinity" of the liquid state was observed by Danilov in liquid eutectic alloys(Izvest. Akad. Nauk S.S.S.R., Sér. Fiz. 5, 30(1941)), by Esin in molten electrolytes (Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk, 561(1948)), and by many authors in aqueous solutions of electrolytes. However, the crystallographic characteristics of microcrystals differ from those of solid monocrystals. It can be surmised that, because of hydrolysis and dissociation, more than one kind of such molecular structures exist in a given solution, and that, contrary to current opinion, crystals obtained from saturated and supersaturated solutions should present differences reflecting those between microcrystals. This was confirmed in an examination of luminescence spectra, at the temperature of liquid air, of a (quickly frozen) 3.6M uranyl sulfate solution and of crystals obtained by the two crystallization methods. There is a considerable difference between the two latter spectra, and a concordance between the spectrum of the solution and that of crystals from the supersaturated solution. At ordinary temperatures luminescence spectra of solutions show a superposition of the two crystal spectra. Other optical properties of the two kinds of crystals also differ. Although both correspond to the formula $UO_2SO_4 \cdot 3H_2O$, drying at 80 deg. results in a loss of 2.5 molecules of H_2O in crystals obtained from saturated solutions, and of only 1.5 H_2O in the case of crystals of the other type.

ENGINEERING

HEAT TRANSFER

1003

A. O. Smith Corp.
LIQUID METAL COOLANT HEAT EXCHANGERS; PROGRESS FOR PERIOD ENDING JULY 15, 1950. E. C. Koerper. July 15, 1950. 3p. (NEPA-1491; ARL-HE-102)

Work on a bismuth cooler, changes to the expansion end of a liquid-to-liquid heat exchanger, references to a liquid-to-air radiator, and corrosion and erosion testing are briefly indicated.

RADIOGRAPHY

1004

COBALT-60 FOR INDUSTRIAL RADIOGRAPHY. J. C. Pennock. Tracerlog, No. 31, (1950) Dec.

The theory of radiography is discussed. Advantages of Co^{60} for industrial radiography are summarized as follows: low cost, high specific activity, high-energy γ rays, magnetic handling, long half-life and portability. 14 references.

TRACER APPLICATIONS

1005

LOCALIZATION OF A DISTANT OBJECT MARKED WITH A γ EMITTER (COBALT 60). Pierre Süe and Paul Bélilovsky. J. phys. radium 11, 664-5(1950) Dec. (In French)

An Al box, 1 cm^2 by 1 cm, containing 500 μc of Co^{60}, was movable within a wooden box 50 by 50 by 40 cm. Two end-window counters, provided with long specially designed Pb collimators, were placed outside the large box on supports permitting vertical displacements and rotations in a horizontal plane. A 1-min search was sufficient to localize the source within a 15-cm^3 sphere, while a 5-min operation gave very accurate results, viz., a point determination well within the Al box in 80% of experiments.

VACUUM SYSTEMS

1006

A RELIABLE PIRANI VACUUM SAFETY CIRCUIT. W. Franzen and J. Horton, Rev. Sci. Instruments 21, 935-6 (1950) Nov.

The described circuit is designed to control the operation of valves and similar components automatically in accordance with the pressure in the vacuum system of the Princeton cyclotron.

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

1007

PREPARATION, STRUCTURE, AND APPLICATIONS OF THIN FILMS OF SILICON MONOXIDE AND TITANIUM DIOXIDE. Georg Hass. J. Am. Ceram. Soc. 33, 353-60(1950) Dec. 1.

A material satisfying the chemical formula for silicon monoxide can be prepared by heating finely divided silicon and silica in vacuum. Silicon monoxide is structurally different from either silicon or silica and exists only in amorphous form. Vacuum-deposited thin films of silicon monoxide decompose to silicon and silica when heat-treated in an inert atmosphere and oxidize to silica when heated in air. Their oxidation rates in air at various temperatures have been measured by optical means. Silicon monoxide is especially suitable for depositing protective layers on first-surface mirrors and for preparing replica and support films for electron-microscope and electron-diffraction studies. Titanium dioxide films prepared by evaporating titanium and oxidizing it in air at 400 to 500°C have a rutile structure. Such rutile films can be used for splitting beams and for increasing the reflectivity of first-surface mirrors. (auth)

1008

THE PREPARATION OF ZIRCONIA AND ALUMINA SHAPES. L. E. Mong and J. J. Donoghue. Bull. Am. Ceram. Soc. 29, 405-7(1950) Nov.

A method is described for the preparation of coarse or medium textured zirconia refractories, intended for use at high and fluctuating temperatures where spalling may be serious. Grain-size fractions were proportioned to develop strength. Zirconium sulfate, which decomposes to the oxide, served as a bonding agent. Shapes were formed by hand-molding or semidry-pressing. The method permitted the use of relatively low firing temperatures. Similarly, alumina refractories were prepared, utilizing freshly precipitated aluminum hydroxide jelly as a bonding and plasticizing material. Zirconia shapes prepared by this method by members of the Refractories Section of the National Bureau of Standards during the past ten years have been consistently sound, indicating that the method is satisfactory.

1009

SOME PHYSICAL PROPERTIES OF EIGHT REFRACTORY OXIDES AND CARBIDES. James J. Gangler. J. Am. Ceram. Soc. 33, 367-74(1950) Dec. 1.

An investigation of eight hot-pressed refractory oxides and carbides for possible gas-turbine application was undertaken. Short-time tensile strengths at elevated temperatures, thermal-shock resistances, coefficients of linear expansion, and densities were determined. The compositions of the ceramics included beryllium oxide, magnesium oxide, stabilized zirconia, zircon, boron carbide, 85% silicon carbide plus 15% boron carbide, titanium carbide, and zirconium carbide. The short-time tensile strengths of these ceramics were determined at 1800 and 2200°F. Resistance to thermal shock was determined by rapid cooling in air to room temperature from 1800, 2000, 2200, and 2400°F. The thermal-expansion characteristics of these materials were studied from room temperature to 1100°F. Zirconium carbide was the strongest material at 2200°F with a maximum short-time tensile strength of 15,850 psi; however, it exhibited extremely poor resistance to oxidation. Boron carbide had a short-time tensile strength of 22,550 psi at 1800°F and was the strongest material at this temperature. Boron carbide also had very poor resistance to oxidation and was among the worst compositions investigated in its ability to resist fracture by thermal shock. The evaluation of strength of boron carbide at 2200°F was unsuccessful because the specimens fluxed with the grips. Titanium carbide had the best resistance to thermal shock, and had strengths of 15,850 psi at 1800°F and 9400 psi at 2200°F. It was the most promising of the eight compositions investigated. Hot-pressing of these eight highly refractory bodies indicated that a density of at least 93% of theoretical density could be obtained by this fabrication method. (auth)

1010

THERMAL CONDUCTIVITY AND HEAT CAPACITY OF BERYLLIUM CARBIDE. John J. Neely, Charles E. Teeter, Jr., and James B. Trice. J. Am. Ceram. Soc. 33, 363-4 (1950) Dec. 1.

The thermal conductivity of a hollow hot-pressed cylinder of beryllium carbide has been determined within an accuracy of ±200% from 300 to 950°C. The enthalpy and mean heat capacity of powdered beryllium carbide have been determined within 10 to 15% from room temperature to 1100°C. (auth)

METALS AND METALLURGY

1011

Sylvania Electric Products, Inc.
A PRELIMINARY INVESTIGATION OF THE ZIRCONIUM-BERYLLIUM SYSTEM. H. H. Hausner and H. S. Kalish. Mar. 28, 1949. Decl. Aug. 23, 1949. 28p. (AECD-2969; SEP-13)

Eleven compositions of Zr and Be powders were mixed, pressed at 40 Tsi, and sintered in vacuum (1.5×10^{-4} mm Hg or better) at four different temperatures. Condition of the specimens after sintering, metallographic examination, and x-ray diffraction studies revealed enough information to enable the authors to construct a preliminary phase diagram. The system contains a relatively low-melting-point eutectic and several high-melting-point phases including one of simple cubic structure at about 60% Be which melts well above 1350°C. It appears that small amounts of Zr in Be might have a marked influence upon the physical properties and also enhance sintering of Be. It is shown that the study of a phase diagram can be greatly facilitated by the use of powder metallurgy techniques.

1012

Sylvania Electric Products, Inc.
THE CREEP OF ZIRCONIUM. D. R. Brunstetter and B. H. Alexander. June 9, 1949. 15p. (AECD-3008; SEP-17)

The creep of Zr wires at room temperature and at 200°C has been measured. The results show that Zr is comparable in creep resistance to low carbon steel at room temperature and has considerably higher creep resistance at both room temperature and at 200°C than has annealed copper. (auth)

1013

Knolls Atomic Power Laboratory
A PROCESS FOR HOT PRESSING BERYLLIUM POWDER. A. U. Seybolt, R. M. Linsmayer, and J. P. Frandsen. Aug. 18, 1949. 12p. (AECU-1029)

Beryllium hot-pressed powder compacts of practically theoretical density have been made up to about 12 in. diam and 4 in. thick. Radiographs show such beryllium to be quite uniform and structurally dense, a finding corroborated by metallographic examination. Tensile-test data indicate properties comparable to beryllium fabricated from castings. (auth)

1014

Dow Chemical Co.
THIRD QUARTERLY REPORT; JUNE 1, 1950–AUGUST 31, 1950; PREPARATION OF HIGH PURITY MAGNESIUM AND A STUDY OF THE EFFECT OF NON-METALLIC AND ALKALI METAL IMPURITIES ON THE CORROSION CHARACTERISTICS OF PURE MAGNESIUM. 1950. 39p. (COO-15)

Plots are presented showing the effect of 1 through 8 sublimations on the amount of impurity removed from Mg via the residues. Research on the spectrographic analytical methods has lead to increased sensitivity for alkali metals thus affording a broader evaluation of the contamination picture. The nonmetallic contaminants have also been investigated via the analysis of sublimation residues. Cor-

rosion data on high-purity Mg in various conditions are given.

1015

University of Pittsburgh
PROGRESS REPORT FOR JULY 1, 1950–OCTOBER 1, 1950. W. E. Wallace and E. E. Ketchen. Oct. 9, 1950. 19p. (NYO-750)

Heats of reaction of pure potassium, pure sodium, and fine sodium-potassium with water at 25°C have been measured. From these data the heats of formation of the alloys were computed. Comparison of the data obtained with expectations based on Hildebrand's theory (Hildebrand and Wood, J. Chem. Phys. 1, 304(1935)) of regular solutions and the quasi-chemical theory of Guggenheim and Rushbrooke (Guggenheim, Proc. Roy. Soc. (London) 148A, 304(1935) and Rushbrooke, ibid. 166A, 296(1938)) reveals appreciable discrepancies between theory and experiment. 11 references. (auth)

1016

Columbia University
PLASTIC DEFORMATION AND DIFFUSIONLESS PHASE CHANGES IN METALS; THE BOLD-CADMIUM BETA PHASE. L. C. Chang and T. A. Read. Nov. 15, 1950. 23p. (NYO-755)

Diffusionless transformation in Au-Cd single crystals containing about 50 at % Cd was investigated by means of x-ray analysis of the orientation relationships, electrical resistivity measurements, and motion picture studies of the movement of boundaries between the new and old phases during transformation. The nucleation of diffusionless transformation by imperfections and the generation of imperfections by diffusionless transformation were discussed. 13 references. (auth)

1017

General Electric Research Laboratory
AN ANALYSIS OF THE CREEP OF NICKEL. R. P. Carreker, Jr., and J. H. Hollomon. Sept. 1950. 15p. (SO-2007; RL-433)

Constant-stress creep data on Ni reported elsewhere are critically examined. The data do not indicate the existence of "secondary" creep, in which the strain rate is independent of strain. On the contrary, the data indicate that strain rate is a continuous function of strain and that the relation between strain and time is of the form $\epsilon = Ct^a$ where ϵ = natural strain, t = time, and C and a = constants. (auth)

1018

General Electric Research Laboratory
FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY; SEVENTH QUARTERLY PROGRESS REPORT (PROGRESS REPORT NUMBER 24). J. H. Hollomon and D. Turnbull. Oct. 5, 1950. 9p. (SO-2008; RL-440)

Preliminary experiments indicate that the electromotive force method will be practicable for determining activity coefficients in the Co-Pt system. A program has been initiated to measure the heat capacity of graphite from 12 to 300°K. The corrected free energy of Cu grain boundaries in specimens of random orientation is reported to lie between 500 and 600 ergs/cm^2. (auth)

1019

Oak Ridge National Laboratory, Y-12 Area
DENSITY OF HAFNIUM AND ZIRCONIUM METALS. Fred P. Boody. Nov. 16, 1950. 8p. (Y-696)

The absolute density of three samples of Hf metal was found to average 12.62 g/cc at 28.3°C, and that of four samples of Zr metal was found to average 6.499 g/cc at 26.4°C. The value for Zr checks very closely with that found in the literature. The value for Hf differs significantly from the few references found. This could be due to such a factor as the presence of ~2% Zr in the Hf used for this work. Calculations, on the basis of the formula $[(\text{at. wt Hf})/(\text{at. wt Zr})] \times \rho\ \text{Zr} = \rho\ \text{Hf}$, may logically be used as a check, inasmuch as the ionic and atomic radii and the crystal structures of Zr and Hf are virtually identical. The calculation gives a density for Hf of 12.73, which is in much closer agreement with the value resultant from this work than with those heretofore published.

1020

EFFECT OF HEAT TREATMENT ON THE ELECTRICAL PROPERTIES OF GERMANIUM. H. C. Theuerer and J. H. Scaff. J. Metals (N.Y.) 191, 59-63(1951) Jan.

Germanium may be reversibly converted from n to p type by heat treatment. Data for the conversion and the associated changes in resistivity are given, and the results are interpreted in terms of changes in the donor-acceptor balance.

1021

Geological Survey
A GLOSSARY OF URANIUM- AND THORIUM-BEARING MINERALS. Judith Weiss Frondel and Michael Fleischer. Apr. 1950. 20p. (GS-C-74)

The glossary is divided into four groups: A, minerals containing U and Th as major constituents; B, minerals containing minor amounts of U and Th; C, minerals that, if investigated by modern analytical methods, might show U or Th content; and D, minerals that are non-U- or non-Th-bearing, but that have been reported to contain impurities or intergrowths of U, Th, or rare-earth minerals.

1022

METALLOGRAPHIC STUDY OF THE MARTENSITE TRANSFORMATION IN LITHIUM. J. S. Bowles. J. Metals (N.Y.) 191, 44-6(1951) Jan.

Techniques have been developed for the metallographic examination of lithium, and the microstructural characteristics of lithium martensite are described. The lithium habit plane has been shown to be approximately {441}. This is not in agreement with Burgers' prediction of {112} but is closely similar to the habit planes utilized in other martensite transformations in body-centered cubic metals. 11 references.

1023

PERIODICITIES IN THE INFLUENCE OF ADMIXTURES OF VARIOUS ELEMENTS ON MECHANICAL PROPERTIES OF COPPER, SILVER, AND GOLD. B. B. Gulyaev. Doklady Akad. Nauk S.S.S.R. 74, 1089-92(1950) Oct. 21. (In Russian)

In a previous paper (Doklady Akad. Nauk S.S.S.R. 70, No. 5 (1950)) periodic relationships were shown to exist between the mechanical properties of elements and their atomic numbers. A similar examination is made here of mechanical characteristics (tensile strength and elongation) of binary alloys of Cu, Ag, and Au as functions of atomic numbers of admixed elements. Clear periodic dependences are found, the strongest influence on the properties of the alloys being exercised by elements belonging to the middle groups of the periodic table.

1024

Illinois Institute of Technology
THE REACTIONS OF METALS WITH GASES AT HIGH TEMPERATURES; THE MELTING POINT-COMPOSITION DIAGRAM OF THE ZIRCONIUM-OXYGEN SYSTEM; TECHNICAL REPORT NO. 6. Daniel Cubicciotti. May 1950. 17p. (NP-1899)

The solidus curve of the zirconium–zirconium dioxide system has been determined by observing the melting points of wires of the oxidized metal. The results show that, near the melting points, oxygen dissolves to the extent of 55 at. % in solid Zr metal, while Zr dissolves in the solid dioxide to form a 15 mole % solution. No evidence was found for compounds other than the dioxide. (auth)

MINERALS AND MINERALOGY

1025

M.I.T. Department of Metallurgy
RADIOMETRIC RESEARCH; PROGRESS REPORT. James H. Pannell, Emilia M. Rubino, and Elizabeth W. Warren. Aug. 4, 1947. Decl. Oct. 19, 1950. 26p. (AECD-2964)

References are made to the assaying of ordinary samples containing 0.05% or more U_3O_8, to an automatic sample changer (Progress Report A-28), and to an excess of radioactivity present in slime tailings relative to the amount of uranium present as determined by chemical methods. The report also contains the results of three different lines of research. One is a study of the selective absorption of radiation as a means of investigating the nature of the emitter element without employing a proportional counter, ionization chamber, or other more refined apparatus. The second is a preliminary study of the possibilities for the continuous recording of radioactivity changes during flotation. The third relates to efforts to employ radiometric methods to the analysis of leach liquors.

1026

ON HOLMQUISTITE. A. I. Ginzburg and I. V. Ginzburg. Doklady Akad. Nauk S.S.S.R. 74, 1119-22(1950) Oct. 21. (In Russian)

The lithium-containing amphibole holmquistite has been found in two localities only, one in Sweden and another in North Carolina (Palache et al., Am. Mineral. 15, No. 8 (1930); Sundius, Geol. Fören. i Stockholm Förh. 69, No. 1 (1947)). The occurrence of this mineral in U.S.S.R. in a spodumene (lithium pyroxene)-bearing site in a gabbro-anorthosite massif is reported here. It forms groups of very elongated crystals (up to 2 cm long) both in the outer zone of pegmatitic bodies and in the surrounding rock, often as far as several dozen yards from the pegmatite. The contact action of the spodumene-bearing body on the surrounding basic rock results in the formation of lithium-containing biotites in the vicinity of the contact, and in a replacement of hornblende by holmquistite farther away. This circumstance may have a considerable prospecting value; the finding of a single needle of holmquistite in a basic formation should indicate the presence of rare-metal-bearing pegmatites of the lithium type.

1027

STUDIES OF URANIUM MINERALS (V): PHOSPHURANYLITE. Clifford Frondel. Am. Mineral. 35, 756-63(1950) Sept.-Oct.

The ill-defined uranium mineral, phosphuranylite, hitherto known only from North Carolina, is redescribed from twelve new localities. Phosphuranylite is isostructural with dewindtite, $Pb_3(UO_2)_3(PO_4)_4(OH)_4 \cdot 10H_2O$, and its ideal formula is presumed to be $Ca_3(UO_2)_3(PO_4)_4(OH)_4 \cdot 10H_2O$. Analyses show much less Ca than required by this formula. The mineral occurs as dense golden-yellow films composed of microscopic rectangular plates, and is found principally in the weathered zone of pegmatites containing uraninite. Crystallization is tetragonal or orthorhombic. Optically, it is biaxial negative with somewhat variable indexes: nX = 1.660 to 1.690 (colorless to pale yellow), nY = 1.696 to 1.724 (golden yellow), nZ = 1.698 to 1.724 (golden yellow); 2V = 0 to 35 deg; r > v strong. Pb substitutes for Ca in some varieties with accompanying increase in indexes of refraction. (auth)

TRACER APPLICATIONS

1028

THE APPLICATION OF RADIOACTIVE TRACER TECHNIQUES TO THE STUDY OF THE MOVEMENT OF OIL IN SANDS. S. E. Coomber and E. N. Tiratsoo. J. Inst. Petroleum 36, 543-60(1950) Sept.

This paper describes the results of preliminary investigations into the possibility of using radioisotopes in following the movement of oil in sand bodies. The basic theory of radioactive tracer work is outlined, and details are given of the apparatus employed and the technique recommended. Methods of measuring the absorption properties of laboratory materials for the radiation of radioactive iodine are described, and the bearing of the results on quantitative measurement is discussed. Experiments have been made on the movement of oil through sands of differing grades and its accumulation at a coarse-fine interface in order to define the technique and reliability of such measurements in dynamic conditions. The potentialities of these techniques in reservoir-engineering investigations is outlined. (auth)

PHYSICS

1029

Rutgers University
FOURTH ANNUAL PROGRESS REPORT ON NUCLEAR AND ELECTRONIC PARAMAGNETISM AND LOW TEMPERATURE STUDIES. F. G. Dunnington. Sept. 1, 1950. 63p. (NP-1873)

Nuclear Magnetic Resonance Studies. H. C. Torrey, N. L. Alpert, and F. G. Dunnington. Progress is reported on measurement of relaxation constants in proton-containing solids and liquids as a function of temperature (apparatus and theory are described, and results are given for CH_4, HCl, HBr, HI, and H_2S), investigation of the pulse method, and construction of an r-f spectrometer and its use with hydrogen-palladium solutions.
Electronic Paramagnetism. C. A. Whitmer, R. T. Weidner, and P. R. Weiss. Work has continued on diluted paramagnetic salts of the iron group at room and at liquid-nitrogen temperatures. The salts investigated comprise iron ammonium alum, iron potassium alum, chromium sesquioxide, and an unusual organic salt (diphenyl trinitrophenyl hydrazyl). A cryostat for use at liquid-helium temperatures has been constructed and tested. An apparatus for measuring dielectric constants of these salts at microwave frequencies as a function of temperature has been completed and preliminary results obtained.
Low-temperature Studies. B. Serin and C. A. Reynolds. The studies using the technique of superimposing alternating and direct current on a superconductor and observing the average electromative force as a function of the amplitude of the alternating current have been brought to conclusion. Studies on the superconductivity of mercury isotopes and on low-temperature resistance minima in metals are reported.
Theoretical Studies. P. R. Weiss. Calculations are being made to determine the influence of nuclear quadrupole moments of paramagnetic ions of the Fe group on electronic microwave spectra. Detailed computations have been made on Cu.

1030

M.I.T. Research Laboratory of Electronics
[NINETEENTH QUARTERLY PROGRESS REPORT FOR THREE-MONTH PERIOD ENDING SEPTEMBER 1, 1950.] A. G. Hill, J. B. Wiesner, and G. G. Harvey. Oct. 15, 1950. 80p. (NP-1878)

References to work are made on approximately 60 problems distributed in the fields of physical electronics, microwave gaseous discharge, solid-state physics, low-temperature physics, molecular beam research, microwave spectroscopy, magnet laboratory research, tube research and development, communication research, and air navigation.

ASTROPHYSICS

1031

PROTON-NEUTRON CONCENTRATION RATIO IN THE EXPANDING UNIVERSE AT STAGES PRECEDING THE FORMATION OF THE ELEMENTS. Chushiro Hayashi. Progress Theoret. Phys. (Japan) 5, 224-35(1950) Mar.-Apr.

Cosmogonic theories of Gamow (Revs. Modern Phys. 21, 267(1949)) and of Alpher et al. (Phys. Rev. 75, 1089(1949)) assume a hot primordial matter consisting solely of neutrons, and deduce the formation of elements, during the cooling down that accompanied the expansion of the universe, from nuclear reactions of radiative captures and beta decays. The present author perceives certain difficulties inherent in the above assumption and shows that the period of formation of elements was preceded by others, during which protons were abundantly formed. Thus, at a stage when the universe was more compressed and hotter ($kT \gtrsim mc^2$; m is an electron's mass), there were, in addition to the natural decay of neutrons, induced β processes, caused by energetic electrons, positrons, neutrinos, and antineutrinos, and resulting in the formation of protons. At a still earlier stage ($kT \gtrsim \mu c^2$; μ is a meson's mass), meson-induced conversions n – p were especially abundant.

COSMIC RADIATION

1032

Syracuse University
A HODOSCOPE STUDY OF PENETRATING COSMIC-RAY SHOWERS. Kurt Sitte. Sept. 29, 1950. 20p. (NYO-510)

Showers produced locally in a Pb absorber were studied with a hodoscope arrangement. It is shown that, in order to record "local penetrating showers," a rigid selection of events demanding high penetrating power of the secondaries as well as of the primary must be used. If this is done, some of the discrepancies of recent investigations are removed. For showers capable of penetrating at least 200 g/cm^2 Pb a collision mean free path of (162 ± 10) g/cm^2 is found. For showers of at least 100 g/cm^2 penetration, a mean free path of (196 ± 13) g/cm^2 is determined. "Local soft showers" due to electronic or photonic secondaries of ordinary μ mesons were studied. Their frequency at 3260-m elevation is about 1 in 10^5 traversals of the Pb absorber. The interactions of penetrating particles in extensive air showers have been studied with a hodoscope arrangement at an altitude of 3260 m. About 90% of all charged penetrating particles do not originate locally, showers of penetrating secondaries, and are absorbed only very slowly. This "non-interacting component," consisting at least predominately of μ mesons, has a rather flat range spectrum between 280 and 680 g/cm^2 Pb. Its zenith angle distribution is approximately proportional to $\cos^4 \theta$. The remaining 10% constitute a "charged N-component"; the total fast N-component amounts to about one-fourth of the number of the charged penetrating particles. The collision mean path of the fast N-component was found to be (220 ± 30) g/cm^2 if a minimum of 100 g/cm^2 penetration is demanded for the local showers. From the recorded increase of the number of shower particles with absorber thickness it is concluded

that further multiplication after the first collision is quite common, and that the mean free path of the secondaries of local showers is not much larger than that of the primary N-component. 21 references. (auth)

1033

ABUNDANCE OF LITHIUM, BERYLLIUM, BORON, AND OTHER LIGHT NUCLEI IN THE PRIMARY COSMIC RADIATION AND THE PROBLEM OF COSMIC-RAY ORIGIN. H. L. Bradt and B. Peters. Phys. Rev. 80, 943-53(1950) Dec. 15.

A combination of sensitive and insensitive photographic emulsions was used to improve the accuracy of measurement of the specific energy loss of relativistic nuclei. The method was applied to the determination of the charge spectrum of the primary cosmic radiation at geomagnetic latitude $\lambda = 30$ deg and resulted in nearly complete resolution between neighboring elements up to $Z \sim 14$. It is shown that lithium, beryllium, and boron nuclei are almost or entirely absent in the primary cosmic-ray beam. Since nuclear disintegrations of energetic heavy ions frequently lead to fragments of $3 \leq Z \leq 5$, it is concluded that most heavy primary nuclei do not suffer nuclear collisions between the time of acceleration and arrival and that this time must be less than $10^6/\rho$ years, where ρ is the density of atoms along the trajectory. This result seems to be in disagreement with several recent theories on the origin of cosmic rays and raises some general difficulties for theories assuming galactic origin. (auth)

1034

A CONTRIBUTION TO THE STUDY OF EXTENSIVE SHOWERS. PART II. E. Amaldi, C. Castagnoli, A. Gigli, and S. Sciuti. Nuovo cimento 7, 816-34(1950) Oct. 15. (In Italian)

The discussion of experiments described in Nuovo cimento 7, 401(1950) is continued, and it is shown that although the observed multiplication of particles in an extensive shower agrees with theory, the measured value of the exponent of the spectrum differs from the calculated one. The discrepancy cannot be attributed to the particular distribution law assumed in the calculation because, in theory, the exponent is not sufficiently sensitive to any distribution peculiarities in the vicinity of the shower's axis, or to the presence of any tail in the distribution curve. The discrepancy is thought to be caused by the influence of showers not fully developed. (auth)

1035

THE MEAN SQUARE DEVIATION OF THE NUMBER OF ELECTRONS AND QUANTA IN THE CASCADE THEORY. H. J. Bhabha and A. Ramakrishnan. Proc. Indian Acad. Sci. 32A, 141-53(1950) Sept.

On the basis of the quantum-mechanical cross sections for radiation emission by electrons and pair creation by quanta when screening is complete, the fluctuation in the mean number of electrons and photons in any given energy interval in a cascade is calculated. The expression for the mean-square deviation of this number is given explicitly in the form of a double integral which can be evaluated by the saddle-point method. (auth)

1036

NOTE ON THE COMPLETE STOCHASTIC TREATMENT OF ELECTRON CASCADES. H. J. Bhabha. Proc. Indian Acad. Sci. 32A, 154-61(1950) Sept.

A result already established by Scott and Uhlenbeck (Phys. Rev. 62, 497(1942)) for a model in which there is only one type of physical entity involved is extended to the actual cascade process. It is shown that, with the sole approximation of neglecting the angular divergence of showers, complete information about the stochastic process of cascade generation can be calculated. The qth order correlation functions are expressed as integrals involving the $(q-1)$th order correlation functions and the two independent elementary solutions of the cascade equations. The latter are the usual functions giving the mean number of electrons and photons in cascades excited, respectively, by a single electron or photon of some definite energy. If the latter are known exactly, then all the higher order correlation functions can be calculated by repeated integration. One thus obtains explicit expressions for the mean of the qth power of the number of electrons or photons in some finite energy interval and, from this, the probability of finding N particles in this energy interval at a depth t in cascade started by an electron or photon of some given energy. (auth)

1037

REMARKS ON THE LATITUDE EFFECT OF COSMIC RAYS AT SEA-LEVEL. H. D. Rathgeber. Australian J. Sci. Research 3A, 183-92(1950) June. (See also NSA 4-2373.)

During a recent voyage from Australia to Japan the intensity of cosmic rays was measured with several Geiger-counter telescopes of different designs. The conclusions to be drawn from these and other results are presented. It is shown that the latitude effect at sea level (averaged over all azimuths) is approximately proportional to $\cos^3(1.2\zeta)$, where ζ is the zenith angle of the incident radiation, and that the vertical latitude effect is 18%. In general, the latitude effect depends both on zenith angle and azimuth. The phenomenological relationships of these intensity variations with the zenith-angle distribution at two fixed locations, i.e., at high latitudes and at the equator, and with the east-west effect at the equator are deduced. After correction for longitude and zenith angle, Geiger-counter-telescope and ionization measurements do not differ by more than their errors of measurements; the average specific ionization does not vary with latitude. Qualitative explanations of the equality of the latitude effects for mesons and for electrons, as well as of the latitude effect of small extensive showers, are given. 24 references. (auth).

ELECTRONS

1038

INFLUENCE OF NUCLEAR DIMENSIONS ON BREMSSTRAHLUNG. G. S. Saakyan. Zhur. Eksptl'. i Teoret. Fiz. 20, 787-94(1950) Sept. (In Russian)

If finite dimensions of the nucleus are taken into consideration, the calculation of differential cross sections for large-angle scatterings of electrons with energies $E_0 \geq 125/A^{1/3}$

Mev (A is the mass number) results in smaller values than those obtained when no such allowance for dimensions is made. In the limiting case $E_0 \gg 125/A^{1/3}$ Mev, the ratio between the two values is ½. It follows that observations on electron scatterings at large angles (about $\pi/2$) will permit determinations of nuclear radii and nuclear charge distributions. A study is made of the case of large-angle bremsstrahlung, which results in formulas involving nuclear dimensions. (auth)

GASES

1039

EFFECT OF MAGNETIC FIELDS ON TRANSPORT PHENOMENA (DIFFUSION) IN GASES. Hermann Senftleben and Heinz Schult. Ann. Physik 7, 103-9(1950) Feb. 10. (In German)

Several aspects of the general problem of the influence of magnetic fields on transport phenomena in gases, such as heat conduction and internal friction, have been thoroughly investigated; however, no such experimental study has ever been made of diffusion processes because of difficulties encountered in eliminating the effect of magnetostriction. The authors devised a procedure avoiding this difficulty and yet sensitive enough to demonstrate the anticipated slight effect. In a 10,000 gauss field, the relative decrease of the diffusion coefficient of the pair hydrogen-oxygen is about 10^{-4}, an order of magnitude expected on the basis of heat-conduction and internal-friction studies. (auth)

INSTRUMENTS

1040

Associated Electrical Industries, Ltd., Aldermaston, Berks. GAS RECOVERY AND STORAGE SYSTEM FOR PRESSURIZED ELECTROSTATIC GENERATOR. S. E. Hunt. Aug. 1949. 26p. (A.55(AEI))

The relative advantages of storing the dielectric gas at high pressure (3000 psi) and medium pressure (400 psi) are discussed, and the medium-pressure storage system is decided upon. A medium-pressure gas system which provides facilities for drying, evacuating, emptying, and filling the tank and also for circulating, drying, and cooling the gas while the machine is in operation is discussed in detail. The system is capable of being used for nitrogen or nonpermanent dielectric gases. (auth)

1041

M.I.T. Department of Mechanical Engineering LIQUID NITROGEN-COOLED MAGNET; TECHNICAL REPORT NO. 1. S. C. Collins, C. D. Fulton, Jr., and M. R. Bent. July 15, 1950. 6p. (NP-1882)

A magnet is described, the principal space-saving feature of which is the use of graded sand which provides adequate electrical insulation without hindering heat transfer.

1042

A METHOD FOR PRODUCING BEAMS OF MOLECULES. D. L. Simonenko. Zhur. Eksptl'. i Teoret. Fiz. 20, 385-9 (1950) May. (In Russian)

A new method of producing molecular beams avoids the use of the furnace. A beam of positive ions, obtained from any ion source, is neutralized by slow electrons crossing the path of the ions; neutral molecules so obtained continue to move in the direction and practically with the velocity of the ions, while nonneutralized ions can be easily removed by an electric or a magnetic field. A nitrogen-ion beam with a current density 1.3×10^{-7} a/cm² was completely neutralized by a stream of 50-ev electrons of a current density 1.5×10^{-3} a/cm². Using modern ion sources, very intensive molecular beams can be obtained, whose velocity is varied by changing the accelerating potential of the ion source; the beams are made monochromatic by employing the usual electric velocity filters.

1043

MOLECULAR BEAM DETECTION BASED ON THE CONDUCTIVITY OF THE DEPOSIT. M. I. Korsunskiĭ, L. I. Pivovar, and A. M. Markus. Zhur. Eksptl'. i Teoret. Fiz. 20, 860-1(1950) Sept. (Letter to editor; in Russian)

While the conductivity of very thin-metal films (less than 10^{-6} cm) is a complicated function of the thickness, that of thicker films changes linearly with thickness increments. A device for measuring the intensity of molecular beams is based on these relationships. The molecular beam is used first for the deposition of two metal strips, about 10^{-6}-cm thick, on a glass plate having two wire electrodes embedded in it. By branching the strips into a Wheatstone bridge, and depositing further thicknesses of metal from the molecular beam, the desired measurements of the beam intensity can be made by bridge adjustments.

1044

MULTIPLIER PHOTOTUBES IN SCINTILLATION COUNTERS. R. E. B. Hickman. Electronic Eng. 22, 474-6 (1950) Nov. .

Of the two principal types of multiplier phototubes, the static and the dynamic, only the former has been used to any extent in experiments in scintillation counters. Static multipliers may in turn be subdivided into several classes, including magnetically focused, electrostatically focused, and unfocused. Of these, the most generally useful for scintillation counting is the electrostatically focused. Commercially available are the types 931A, 1P21, 1P22, 1P28, and 5819. The principle of operation of scintillation counters, dark-current pulses, factors affecting pulse rate, pulse output under light stimulation, and circuit arrangements are also discussed.

1045

PULSE AMPLIFIER FOR FAST IONIZATION CHAMBERS AND PROPORTIONAL COUNTERS. Electronic Eng. 22, 469(1950) Nov.

Specification 120 issued by the Atomic Energy Research Establishment, Harwell, describes the pulse amplifier

Type 1049B, which has been designed primarily for use with fast ionization chambers and proportional counters. The upper half-power frequency of the amplifier is 2 Mc/sec, thereby making the equipment particularly useful for coincidence work and counting in the presence of high backgrounds. There are two units: a head amplifier which may have its maximum gain set to 100 for ionization chamber work or to 5 for proportional counter work, and a main amplifier with a maximum gain of 10,000 and which contains all the necessary power supplies. The technical details of the two units are indicated.

1046

A PULSE GENERATOR FOR THE MILLIMICROSECOND RANGE. R. L. Garwin. Rev. Sci. Instruments 21, 903-4 (1950) Nov.

A description is given of a laboratory pulse generator producing pulses with rise and decay times less than 2×10^{-10}/sec at a repetition rate of 120/sec. Three simultaneous outputs are available, variable in amplitude from 100 μv to 100 volts and accurate to a few per cent. (auth)

ISOTOPES

1047

THE NATURAL ABUNDANCE OF ^{13}C AND ^{18}O AND THE ALTERATION OF ISOTOPIC ABUNDANCES IN THE EQUILIBRIUM BETWEEN HYDROCYANIC AND ACETIC ACIDS IN SOLUTION; trans from Z. NATURFORSCH., 5a, 174-5 (1950). (In German) Erwin Willy Becker and W. Vogell. 1950. 4p. (NP-2235)

Measurements of the natural abundance of C^{13} were made with highly purified CO_2, prepared by conversion of HCN, with CO as intermediate product. This also provided a good opportunity to measure the natural abundance of O^{18}. Since accuracy in the determination of rare isotopes such as C^{13} and O^{18} depends mainly on the resolving power of the spectrometer, a spectrogram of the corresponding masses is shown. Results indicate that $C^{13} = (1.12_4 \pm 0.005)\%$ and $O^{18} = (0.205_9 \pm 0.003)\%$. The shift in isotopic abundance caused by the equilibrium HCN_{gas}/HCN_{soln} (CH_3COOH) has been investigated. The C^{13} is found to be enriched by approximately 0.2% in the liquid phase. This indicates that the hydrocyanic acid dissolved in the glacial acetic acid can be only slightly dissociated. (See also NSA abstract 4-4635)

1048

NATURAL CLASSIFICATION OF ATOMIC NUCLEI AND THE PROBLEM OF ELEMENT 61. N. A. Novosel'skaya. Doklady Akad. Nauk S.S.S.R. 74, 921-3(1950) Oct. 11. (In Russian)

The recent discovery of the element 97 confirmed the predictions of Znoĭko (Doklady Akad. Nauk S.S.S.R. 68, No. 5; 69, No. 2, (1949)), based on his periodic table of isotopes in which the number of possible isotopes, their relative stability, lifetime, and type of radioactivity are deduced, according to certain rules, from the corresponding properties of neighboring isotopes (isobars, etc.) and from the ratios Z/A. With the aid of that table, the problem of the existence in nature of the element 61 is discussed. It is concluded that no stable isotope of this element can exist; however, among predictable radioactive isotopes, 61^{145} must be an α emitter with a half-life 10^7 to 10^9 yr. It will be found with other rare earths, most likely with Sm.

ISOTOPE SEPARATION

1049

Oak Ridge National Laboratory
THE ENRICHMENT OF LITHIUM ISOTOPES BY ION EXCHANGE. John H. Gross. [nd.] Decl. Nov. 29, 1950. 3p. (AECD-2952)

Partial separations of the isotopes of lithium have been accomplished by an ion-exchange method using commercially available sulfonated styrene – divinyl benzene ion-exchange polymers. The Li^+ was developed from an initial 5-cm band of saturated exchanger through a 146-cm bed of hydrogen-form exchanger with 0.1M HCl at a flow rate of 0.18 cm/min at 30.0°C. The exchanger particle-size range was 80 to 200 μ. Mass analysis indicated that after only 0.05% of total Li had been eluted the concentration of Li^7 had increased from 92.476 to 94.397 at. %. It is suggested that this separation may depend on differences in the exchange equilibriums of the isotopes rather than on differences in diffusion rates.

1050

Columbia University
ANNUAL PROGRESS REPORT; SEPARATION OF ISOTOPES BY CHEMICAL EXCHANGE IN THERMAL DIFFUSION COLUMNS; CHEMISTRY DEPARTMENT. William P. Senett, Russell W. Pierce, and T. I. Taylor. July 1, 1950. 28p. (NYO-623)

Results on the effect of time, pressure, and temperature on the thermal-diffusion-column separation of the nitrogen isotopes, using the NO_2–NO system, are given graphically. Investigation of oxygen-isotope separation on the same system has produced data confirming oxygen enrichment concurrent with nitrogen enrichments. Statistical thermodynamic calculations of the enrichment factor have confirmed the possibility of observing this effect. Preliminary to testing columns of different designs under optimum conditions, particular emphasis has been placed on systems for the study of chemical converter and for the comprehensive investigation of catalysts suitable for chemical exchanges. (auth)

1051

Oak Ridge National Laboratory, Y-12 Area
CHEMICAL EXCHANGE AS A VERSATILE ISOTOPE SEPARATION PROCESS. G. H. Clewett. Nov. 7, 1950. 27p. (Y-683)

For the lighter elements, the chemical exchange method is generally accepted as being one of the most efficient. The close approach to thermodynamic equilibrium achieved in chemical exchange processes with resultant minimal expenditure of energy at each stage leads to highly efficient low-cost production. The specifications to be met by a

suitable chemical exchange system are reported as follows: the element must be distributed between two phases, rapid isotopic exchange must take place between the chemical forms in the two phases, and the equilibrium constant of the isotopic exchange reaction must be other than unity. Engineering requirements are as follows: the two immiscible phases of the chemical exchange system must be efficiently contacted as countercurrent streams, the apparatus must have low holdup and high throughput, and means for achieving total reflux at the top and bottom of the plant must be provided. Enrichment of N^{15} by exchange between NH_3(gas) and NH_4^+ (liquid) is used as an example. 34 references.

1052

CONCENTRATION OF A^{36} AND A^{38} AND STUDY OF THE $A^{36}(d,p)A^{37}$ REACTIONS AND THE BETA ACTIVITY OF A^{39}. A. Zucker and W. W. Watson. Phys. Rev. 80, 966-9(1950) Dec. 15.

The concentration of A^{36} up to 95.9% by the thermal-diffusion method is described. Observations of the proton groups resulting from the deuteron bombardment of this gas give the following Q values for the $A^{36}(d,p)A^{37}$ reaction: 6.49, 5.05, 3.93, 2.95, 2.09, 1.86, 1.42, and 0.64 Mev. Comparison with the proton distribution from $A^{40}(d,p)A^{41}$ shows the importance of having well-separated isotopes for the resolution of proton groups of nearly the same energy from each isotope. The enrichment of A^{38} to 0.75% in this same gas makes measurement possible on the β particles from the $A^{38}(d,p)A^{39}$ reaction. These A^{39} β particles have a half-life of 160 ± 5 sec and a maximum energy of about 2.1 Mev. (auth)

1053

ON PROCESSES OF H-D EXCHANGES ON THE SURFACE OF AN ALUMINUM CATHODE, WHICH DEPEND ON THE CONCENTRATION. Eva Kühne-Sauter. Z. Naturforsch. 5a, 499-501(1950) Sept. (In German)

A deuterium-enrichment process has been investigated. The process takes place on an Al surface which, after having been moistened with D_2O-H_2O mixtures of known concentrations, serves as a cathode in a spectroscopic glow-discharge tube. Spectroscopic measurements showed that the above D enrichment was replaced by a D impoverishment whenever the volume ratio D_2O/H_2O in the original mixture was less than 1/400. (auth)

MATHEMATICS

1054

ON CONVERGENCE IN THE PERTURBATION METHOD. PART II. Tosio Kato. Progress Theoret. Phys. (Japan) 5, 207-12(1950) Mar.-Apr. (See also NSA 4-2481.)

This is the second half of a paper on the problem of convergence in the perturbation method, the first part having been published in Progress Theoret. Phys. (Japan) 4, 514 (1949). It is shown that asymptotic series are obtained provided the coefficients can be calculated by means of operations within the Hilbert space.

MEASURING INSTRUMENTS AND TECHNIQUES

1055

Brookhaven National Laboratory
THE MASS "SYNCHROMETER" AND MEASUREMENT OF THE MASS OF S^{32}. (abstract) Lincoln G. Smith. Oct. 6, 1950. 1p. (AECU-1068)

The report is reproduced here in its entirety.

A new method has been developed for accurately measuring the rotation period T of ions in a uniform magnetic field. After passing through a slit 180 deg from the source, ions are subjected to an electric field of small extent in space and time. Thus is formed a short bunch having reduced energy and free to execute a large number n of rotations in the same plane without striking the source. Reestablishment of the electric field at time nT later further reduces the energy of the bunch so that it strikes a detector. Electronic measurement of the interval between two applied voltage pulses for maximum current to the detector yields a value of the ionic mass. From measurement of the time difference for S^+ and O_2^+ bunches (n = 40, nT = 840 μsec) formed in SO_2, a value S = 32.9823 ± 0.0010 [sic] agreeing with Aston's has been obtained. This result indicates, but does not prove, that a more recent value (Okuda and Ogata, Phys. Rev. 60, 690L(1941)) is too high. Results to date have been obtained in a small preliminary instrument. A larger "synchrometer" employing higher fields, believed capable of a precision of 10^6 or better, is being designed.

1056

Brookhaven National Laboratory
RADIATION DETECTION INSTRUMENTS. William A. Higinbotham. [nd.] 23p. (AECU-1082)

The general nature of radiation, ionization chambers, proportional counters, Geiger counters, scintillation counters, and neutron detection is presented briefly. 10 figures.

1057

Sylvania Electric Products, Inc.
PORTABLE ALPHA-BETA-GAMMA METER; FINAL REPORT RD-386. June 30, 1950. 15p. (M-4508)

Results are reported of a project to develop and produce 25 portable α-β-γ survey meters, primarily intended for use in the detection and measurement of α sources spilled on flat surfaces. Development work resulted in improved design, mechanically and electrically, of the Model 356 alpha survey meter developed for the USAEC by the Radiological Instrument Laboratory. Redesign was predicated on use of the instrument mainly in laboratories dealing with radioactive materials with the understanding that the instrument would also be used outside the laboratory, and might be subject to rough usage and unfavorable weather conditions. General considerations, project objectives, theoretical and design considerations, and performance testing are detailed. Photographs of the finished instrument and its components are included.

1058

Radiation Instruments Branch, AEC
RADIATION INSTRUMENT CATALOG; CATALOG NO. 2; PART I AND PART II. 1950. 604p. (RIB-7)

The catalog is arranged according to accessories, special components, scalers, monitors, personnel (monitors), and survey meters. The name of the item, an AEC number, the manufacturer's model number, the name of the manufacturer, a functional description usually including a photograph and weight and dimensions, and informative remarks are included for each article presented. A list of manufacturers of radiation detection instruments, an index to the catalog, and the name of a person with each company from whom information may be obtained are also included.

1059

University of California
STUDIES IN BETA AND GAMMA RAY SPECTROSCOPY. Raymond Webster Hayward, Jr. [nd.] 79p. (UCRL-582)

A dissertation at the doctorate level which concerns the study of artificial radioactive isotopes, energies of the components of different β and γ radiations, intensities, etc., is presented. 43 references.

1060

University of California Radiation Laboratory
STARS IN PHOTOGRAPHIC EMULSIONS INITIATED BY PROTONS. Lawrence S. Germain. Sept. 11, 1950. 10p. (UCRL-906)

An abstract of this report was issued and indexed as report UCRL-981 and appeared in its entirety in NSA as abstract 5-664.

1061

Naval Radiological Defense Laboratory
A BETA-RAY SURFACE IONIZATION CHAMBER FOR USE AS A SECONDARY STANDARD. E. Tochilin. Oct. 18, 1950. 18p. (AD-248(P))

A β-ray surface ionization chamber is described which serves as a reliable secondary standard over a wide range of β-ray energies when calibrated against extrapolation chamber measurements. The chamber is used as a dosimeter and is designed for use with either a Victoreen Minometer or a Victoreen Condenser r-Meter, these instruments serving as both electrometers and as charging devices. β-ray dose rates as low as 10 mrep/hr have been measured. A second surface chamber, designed to measure outputs of β-ray plaques used in direct contact with tissue, is also described. Dose rates of 140 rep/min (or 8.4×10^6 mrep/hr) can be measured with this chamber. (auth)

1062

CALCULATION OF THE RELATION BETWEEN ENERGY AND RANGE FOR PROTONS OF 0.1 TO 8 MEV ENERGY AS A FUNCTION OF THE CHEMICAL COMPOSITION OF A PHOTOEMULSION; EXTENSION TO CASES OF DEUTERONS, TRITONS, AND α PARTICLES. Maarten Bogaardt and Léopold Vigneron. J. phys. radium 11, 652-63 (1950) Dec. (In French)

The relation between the energy loss and the energy of protons was calculated using (1) the results of recent experimental studies on absorption, for energies below 0.6 Mev, and (2) Bethe's formula and Mano's ionization-potential data for energies above 0.6 Mev (Bethe, Ann. Physik 5, 325(1930); Z. Physik 76, 293(1932); Mano, Compt. rend. 197, 319(1933); Ann. phys. 11, 407(1934)). Similar curves for deuterons, tritons, and α particles were derived from the relation found for protons, and the results were used for the calculation of a curve for tracks of protons (0.1 to 5 Mev) and α particles (2 to 13 Mev) in an Ilford C_2 emulsion. This curve agrees very satisfactorily with experimental findings. (auth)

1063

Division of Mathematical and Physical Sciences, NRC
CONFERENCE ON ABSOLUTE β COUNTING; PRELIMINARY REPORT NO. 8. H. O. Anger, G. L. Brownell, B. P. Burtt, C. V. Cannon, Martin Deutsch, M. L. Eidinoff, A. L. Hughes, L. D. Marinelli, Theodore Novey, C. A. Tobias, L. Yaffe, and L. R. Zumwalt. Oct. 1950. 60p. (NP-1813)

Separate abstracts have been prepared on the following sections of this report: Standardization and Use of RaE for Absolute β Counting, Paper 1; Standard β Counter, Paper 2; RaDEF Standard Sources for β-Disintegration Rate Determinations, Paper 3; Saturation Backscattering of β Rays, Paper 4; Backscattering of Electrons into Geiger-Mueller Counters, Paper 5; Theoretical Considerations in β-Ray Scattering and Absorption, Paper 6; Coicidence Method of Calibrating Sources, Paper 7; A T-type Counter for β Rays, Paper 8; Measurement of Specific Disintegration Rates by Internal Gas Counting, Paper 9; Calorimetric Measurements of β-Decay Energy, Paper 10; Standardization of γ-Emitting Radioelements, Paper 11.

1064

Division of Mathematical and Physical Sciences, NRC
STANDARDIZATION AND USE OF RaE FOR ABSOLUTE β COUNTING, paper 1 of CONFERENCE ON ABSOLUTE β COUNTING; PRELIMINARY REPORT NO. 8. (Based on: AECU-320) Benjamin P. Burtt. Oct. 1950. 7p. (NP-1813 (paper 1))

The preparation and standardization of RaDE sources are discussed as is their use in determining the disintegration rates of other β emitters. An expression for the counting rate is written as the product of the geometry, the disintegration rate, and a number of factors expressing the effects of resolving-time losses, absorption, and scattering. Corrections for backscattering and absorption are discussed in some detail. A more detailed report of this work is available in AECU-320 (see NSA 3-822). The present paper includes discussions by other members of the conference. 6 figures.

1065

Division of Mathematical and Physical Sciences, NRC
STANDARD β COUNTER, paper 2 of CONFERENCE ON ABSOLUTE β COUNTING; PRELIMINARY REPORT NO. 8. H. O. Anger and C. A. Tobias. Oct. 1950. 5p. (NP-1813(paper 2))

Three methods of absolute standardization were used and compared in an effort to provide good secondary β-ray standards under a range of energies. A standard vacuum counting box was built in which air absorption is eliminated and in which the solid angle between the source and counter window is defined by means of an aperture. The apparatus is suitable for approximate absolute standardization of a number of β emitters. The necessary corrections

are discussed by other members of the conference. 2 figures.

1066

Division of Mathematical and Physical Sciences, NRC
RaDEF STANDARD SOURCES FOR β-DISINTEGRATION RATE DETERMINATIONS, paper 3 of CONFERENCE ON ABSOLUTE β COUNTING; PRELIMINARY REPORT NO. 8. (Based on: AECU-637) Theodore Novey. Oct. 1950. 10p. (NP-1813(paper 3))

The preparation and use of calibrated RaDEF equilibrium sources for absolute β counting are described. The sources are essentially weightless and are mounted on a thin backing to avoid self-absorption and backscattering correction problems. Calibration was done by determination of the α-disintegration rate of RaF in a parallel-plate α ionization chamber. No secondary standards are required, and the sources can be recalibrated at any time. A more detailed report of this work is available in AECU-637 (see NSA 4-853). The present paper includes an extensive discussion by other members of the conference. 4 figures.

1067

Division of Mathematical and Physical Sciences, NRC
BACKSCATTERING OF ELECTRONS INTO GEIGER-MUELLER COUNTERS, paper 5 of CONFERENCE ON ABSOLUTE β COUNTING; PRELIMINARY REPORT NO. 8. L. Yaffe. Oct. 1950. 8p. (NP-1813(paper 5))

The backscattering of electrons into a G-M counter has been studied, and increases in counting rates have been determined. The effect of varying the energy of the β^- emitter, the atomic number, and mass thickness of the backscatterer has been established. Empirical relationships are given from which correction factors may be calculated. The characteristics of the scattered radiation are shown, and suggestions are made for standardizing counting techniques. This material has also been published in a paper by Yaffe and Justis (J. Chem. Soc., Suppl. No. 2 341-51(1949)) in which 48 references are listed.

1068

Division of Mathematical and Physical Sciences, NRC
COINCIDENCE METHOD OF CALIBRATING SOURCES, paper 7 of CONFERENCE ON ABSOLUTE β COUNTING; PRELIMINARY REPORT NO. 8. Martin Deutsch. June 2, 1949. 4p. (NP-1813(paper 7))

The method of coincidence for source calibration depends on the equation $N_0 = N_1N_2/N_c$ where N_1 and N_2 are counting rates of the two detectors and N_c is the coincidence rate, all corrected for various background effects. There are two fundamental requirements: (1) The probability of detecting a given disintegration in one detector must be independent of that of detecting it in the other. (2) The detectors must give only one count per registering particle. Optimum conditions for operation and necessary corrections are presented briefly. An extensive discussion by other members of the conference is given.

1069

Division of Mathematical and Physical Sciences, NRC
A T-TYPE COUNTER FOR β RAYS, paper 8 of CONFERENCE ON ABSOLUTE β COUNTING; PRELIMINARY REPORT NO. 8. A. L. Hughes. June 2, 1949. 2p. (NP-1813(paper 8))

The disintegration rates of Na^{22} and P^{32} have been measured by a T-type G-M counter. The T-type counter consists of a cylindrical counter of Ni or Ag evaporated on the inside of a glass tube about 15 mm in diameter. The effective length of the counter is about 90 mm. From the center of the active region, a side tube of 15-mm diam extends out at right angles. The metallic deposit is carried part way down this side tube. A thick Be disk, flat and highly polished, carrying a thin layer of the radioactive material is introduced into the side tube so that its surface is tangential to the cylindrical G-M tube. A quantity (0.2 ml) of a solution of the active material is placed on the Be disk which is then exposed to a lamp to drive off the solvent. The tube can be evacuated and filled with an argon-alcohol mixture. The characteristics of and results obtained with this counter are presented briefly, and discussions by the conference members are included.

1070

Division of Mathematical and Physical Sciences, NRC
MEASUREMENT OF SPECIFIC DISINTEGRATION RATES BY INTERNAL GAS COUNTING, paper 9 of CONFERENCE ON ABSOLUTE β COUNTING; PRELIMINARY REPORT NO. 8. Maxwell L. Eidinoff. Oct. 1950. 4p. (NP-1813(paper 9))

The use of a glass shield of variable length surrounding the anode wire eliminates counting corrections at the electrode ends. The efficiency of the gas mixture for the detection of β particles from C^{14} has been studied in several ways. These experiments support the use of internal gas counting as a primary method for the absolute standardization of radiocarbon samples. Following a presentation of the advantages and necessary considerations in the use of internal gas counting, a brief discussion by members of the conference is reported.

1071

Division of Mathematical and Physical Sciences, NRC
CALORIMETRIC MEASUREMENTS OF β-DECAY ENERGY, paper 10 of CONFERENCE ON ABSOLUTE β COUNTING; PRELIMINARY REPORT NO. 8. C. V. Cannon. Oct. 1950. 3p. (NP-1813(paper 10))

The construction and sensitivity of an isothermal calorimeter, operating at the temperature of liquid nitrogen and using the rate of vaporization of nitrogen as a measure of the heat input, is described briefly, and some measurements on P^{32}, H^3, and Au^{198} are reported. A brief discussion by members of the conference is included.

1072

Division of Mathematical and Physical Sciences, NRC
STANDARDIZATION OF γ-EMITTING RADIOELEMENTS, paper 11 of CONFERENCE ON ABSOLUTE β COUNTING;

PRELIMINARY REPORT NO. 8. L. D. Marinelli. Oct. 1950. 3p. (NP-1813(paper 11))

A method of standardizing radioelements which emit γ rays according to a known disintegration scheme is described. The principle underlying the method consists in determining the γ-ray flux by means of its absorption in a known mass of air; experimentally, it involves the measurement of electric currents in ionization chambers of finite volume with air-equivalent walls. The use of ionization chambers in standardization of this sort offers the decided advantage of reproducibility, though it requires the use of rather intense sources. Comparison with other standardization methods and suggestions for improved sensitivity are discussed.

1073

A DECADE SCALING CIRCUIT. Ryutaro Ishiwari and Kazunori Yuasa. Mem. Coll. Sci. Univ. Kyoto 25A, 155-8 (1949) Dec.

A new decade-scaling circuit is described as simple and reliable. It is a modification of a scale-of-sixteen vacuum-tube circuit, and is easily restored to its basic circuit when necessary.

1074

AN ELECTROSTATIC BETA-SPECTROGRAPH. Donald R. Hamilton and Leonard Gross. Rev. Sci. Instruments 21, 912-17(1950) Nov.

A β-ray spectrograph has been constructed in which electrons move radially outward against a retarding electric field, and in which the current due to those electrons having more than any given energy is measured. Momentum resolution is 0.33%. The insensitivity of current collection, as compared to single-particle detection, is compensated for by a large tolerable source area and a large useful solid angle subtended at the source by the detector. (auth)

1075

New York University
GEIGER COUNTERS; TIME LAGS; PROJECT NO. 141; REPORT NO. 141-01. Sumner W. Kitchen. Oct. 25, 1950. 44p. (NP-1885)

Measurements were made of the variation in the response time of Geiger counters as a function of filling, geometry, and overvoltage. Variations greater than 5 μsec were found in all cases. The probability of such variation was much less in counters containing argon, hydrogen, ethyl alcohol, and ethyl acetate than in counters containing oxygen. It was tentatively concluded that the primary sources of the variations were the formation of negative ions by dissociation of the vapors and, for the gases, scattering of the initial point of formation of the positive-ion sheath. (auth)

1076

HIGH SPEED SCALER. Electronic Eng. 22, 498(1950) Dec.

A unit, developed by the Atomic Energy Research Establishment, Harwell, is described. This unit consists of a fast, scale-of-ten counter, including an input amplitude discriminator. The instrument is designed for use in front of a normal type of scaler to extend the upper limit of counting rate into the range 10^5 to 10^6 cts/sec.

1077

MEASUREMENT OF GAMMA-RAY ENERGIES WITH THE SCINTILLATION COUNTER. E. H. Belcher. Nature 166, 826-7(1950) Nov. 11. (Letter to the editor)

Lack of resolution when a scintillation counter is used as a γ-ray spectrometer may be reduced by the use of small crystals of high density in a system the optical efficiency of which is as high as possible. Calcium tungstate is particularly suitable, having a density of 6.06 g/cc; a graph shows the differential curve of counting rate against pulse-discriminator setting obtained when a small (0.124 g) crystal of this material placed in direct contact with the envelope of an uncooled 1P21 photomultiplier was irradiated with the γ radiation of Co^{60}. The twin peaks and edges due to the photoelectric absorption and Compton scattering of the two γ rays of energy 1.16 and 1.32 Mev are clearly resolved. Experiments with a small Tl-activated KI crystal and with Au^{198} γ rays are also reported.

1078

SCINTILLATION TYPE ALPHA COUNTER AND ITS APPLICATION IN U AND Th ESTIMATION OF MINERALS. Santimay Chatterjee and Sobhana Dhar. Indian J. Phys. 24, 346-60(1950) Aug.

A scintillation-type α counter using commercial 931-A photomultiplier tubes is described. The luminescence spectrum of the phosphor and the microphotometer analysis are given. The application of this arrangement to U and Th estimation is described. Associated electronic circuits are discussed. The amplifier has an input time constant of 5 μsec. The discriminator pulse-width is 100 μsec and can be decreased to 1 μsec for the high rates of counting to which the apparatus is adaptable. The same arrangement can be used to detect U fission by neutrons.

1079

TWO BETA-GAMMA COUNTERS FOR GAS SAMPLES. Rodman Jenkins. Rev. Sci. Instruments 21, 940(1950) Nov.

In connection with a study of diffusion in turbulent flow, G-M counters of two different types were prepared for the determination of activities of a series of gas samples. In all cases the radiation originated in iodoform containing substantial quantities of I^{131}. The first design was a conventional cylindrical glass counter sealed in a concentric glass jacket. The second type of G-M counter was constructed in order to record a larger fraction of the disintegrations occurring in a given sample. It consists of a ring of six commercial aluminum G-M tubes with their cylindrical axes parallel, sealed within a close fitting, stainless steel chamber.

MESONS

1080

University of California
PRODUCTION OF π MESONS IN LEAD BY HIGH ENERGY PROTON BOMBARDMENT. Mitchel Weissbluth. [nd.] 59p. (UCRL-568)

Experiments with heavier nuclei establish the general order of magnitude of meson-production cross sections and give information regarding successful experimental techniques which is of considerable value in arranging the more fundamental experiments involving hydrogen or deuterium. The characteristics of meson production in Pb bombarded with 345-Mev protons in the external beam of the 184-in. synchrocyclotron have been investigated. It has been found that π mesons emitted from Pb at 90 deg to the direction of the 345-Mev proton beam are distributed over a range 0 to 120 Mev for positives and 0 to 90 Mev for negatives. A peak at about 40 Mev occurs in the positive spectrum with a differential cross section of $(11.8 \pm 2) \times 10^{-30}$ cm^2/Mev/steradian/Pb nucleus; the spectrum of negative mesons has a maximum at about 30 Mev where the cross section is $(11.5 \pm 2.3) \times 10^{-30}$ cm^2/Mev/steradian/Pb nucleus. At low meson energies, about 18 Mev, the ratio of negative to positive π mesons is approximately unity; at higher energies, the ratio becomes smaller and approaches zero at about 90 Mev. A further study was made of the angular distribution of the μ mesons in π-μ decay. The distribution was found to be isotropic. This result is discussed in the light of Wentzel's suggestion (Phys. Rev. 75, 1810(1949)) of the relationship between the angular distribution of the μ mesons and the spin of the π mesons. Detailed consideration is given to classification of observed mesons, calculation methods, experimental techniques, and corrections.

1081

University of California Radiation Laboratory
PHOTO-MESONS FROM CARBON. J. M. Peterson, W. S. Gilbert, and R. S. White. Oct. 16, 1950. 38p. (UCRL-703(Rev.))

Photons from the Berkeley 322-Mev electron synchrotron have been used to produce mesons from a carbon target. These mesons have been observed with nuclear emulsions at angles of 45, 90, and 135 deg to the photon beam. The ratio of the number of π^- to π^+ mesons produced is 1.29 ± 0.22, 1.30 ± 0.12, and 1.34 ± 0.20, respectively, at each of the three stated angles. The energy spectra and the differential cross sections of π mesons at each of these angles have been obtained. The total cross section for the production of π mesons is $(4.0 \pm 1.6) \times 10^{-28}$ cm^2 per nucleus per "equivalent quantum." The number of "equivalent quanta," is defined as the total energy in the beam divided by the maximum photon energy. The cross section for production of μ meson pairs at the target is estimated to be less than 2% of the cross section for π meson production. (auth)

1082

University of California Radiation Laboratory
SUMMARY OF THE RESEARCH PROGRESS MEETING OF APRIL 20, 1950. Henry P. Kramer. Aug. 17, 1950. 14p. (UCRL-711)

Production of Mesons by Protons on Protons at 0 deg to the Beam. W. Cartwright. A 12,000-gauss magnetic field has been used to separate positive and negative mesons produced in the external beam of the 184-in. cyclotron, the mesons being received by stacks of nuclear plates. With 345-Mev protons, a peak is indicated at a meson energy of 65 to 70 Mev.

Proton-Proton Scattering as a Function of Energy. B. Cork. The differential cross section for proton-proton scattering at 90 deg in the center of mass system is plotted in the region 18.8 to 31.8 Mev.

Photoproduction of Mesons from Liquid Hydrogen. A. S. Bishop. The excitation function for production of π^+ mesons by photons, at 90 deg. was plotted from data obtained by detecting the positrons from μ^+-meson decay following the π^+-meson decay.

The Tumor-Host Relationship. K. G. Scott. By administering I^{131}-labeled thyroxin to rats and determining the residue of this radioactive material in the organs of animals with tumors of various sizes, it was found that the uptake of thyroxin in the thyroid decreases with increasing size of tumor. Similarly a quantitative difference was found between the thyroxin content of the intestinal tract of tumorous rats and that of normal animals.

1083

University of California Radiation Laboratory
MEASUREMENT OF THE POSITIVE π-MESON LIFETIME. Clyde E. Wiegand. Oct. 16, 1950. 28p. (UCRL-952)

The use of electronic detectors to determine the lifetime of the π mesons produced in a polyethylene target by the 322-Mev x-ray beam of the Berkeley synchrotron has been investigated. The detectors consisted of two crystals of transstilbene arranged to form a counter telescope at right angles to the beam, the phosphorescent radiation caused by an ionizing particle in either crystal being detected by multiplier phototubes. Pulses were recorded in both differential and integral fashion. The following results for the mean lifetime and half life of positive π mesons are given: $\tau = (2.62 \pm 0.13) \times 10^{-8}$ sec, $T_{1/2} = (1.82 \pm 0.09) \times 10^{-8}$ sec from differential data; $\tau = (2.58 \pm 0.14) \times 10^{-8}$ sec, $T_{1/2} = (1.79 \pm 0.10) \times 10^{-8}$ sec from integral data.

1084

NONSINGULAR TENSOR FORCE IN PSEUDOSCALAR MESON THEORY. S. Endo and S. Tani. Progress Theoret. Phys. (Japan) 5, 310-11(1950) Mar.-Apr. (Letter to the editor)

The so-called r^{-3} singularity is discussed, this singularity appearing when the nonrelativistic nuclear potential is being calculated in the pseudoscalar meson theory, (Araki, Progress Theoret. Phys. (Japan) 4, 195(1949); Van Hove, Phys. Rev. 75, 1519(1949)).

1085

ON THE DECAY OF A HEAVY MESON INTO LIGHTER MESONS. S. Ozaki, S. Oneda, and S. Sasaki. Progress

Theoret. Phys. (Japan) 5, 305-7(1950) Mar.-Apr. (Letter to the editor)

The properties of the heavy τ meson (700 to 1000 e) are discussed in the light of the meson theory of nuclear forces. The possible stages in the observed decay of τ mesons into two or three π mesons and the types of interactions of the mesons involved are considered.

1086

ON THE DECAY OF HEAVY MESONS. PART III. CASE OF THE ASYMMETRICAL INTERACTION. Sadao Oneda, Seibun Sasaki, and Shoji Ozaki. Progress Theoret. Phys. (Japan) 5, 165-76(1950) Mar.-Apr.

In attempting an explanation of the decay of heavy mesons through an interaction with a nucleon field, the γ instability of a charged τ meson should not be overlooked. This problem is treated here with the aid of the Tomonaga-Schwinger formalism. An asymmetry of the matrix elements is introduced by the fact that, while interacting with a proton, a photon does not interact with a neutron. Another interaction to be considered is that between a charged meson and a photon. A search for decay schemes consistent with the experiment is followed by a study of the divergence, gauge invariance, and equivalence theorem of the meson-nucleon-photon coupling, and of the applicability of Pauli's regulator. It is found that the γ decay of a charged τ meson is too short to be detected experimentally.

1087

ON THE ELECTROMAGNETIC PROPERTIES OF MESONS. E. Corinaldesi. Nuovo cimento 7, 892-8(1950) Oct. 15.

Effects of the meson-nucleon interaction on the electromagnetic properties of mesons are examined, these effects being similar to the influence both of the anomalous magnetic moment of protons and neutrons, and of the neutron-electron interaction. It is found that at high energies the Coulomb scattering of mesons can be notably affected by the induced meson current due to the interaction studied. (auth)

1088

ON THE ELECTROMAGNETIC PROPERTIES OF MESONS. T. Kinoshita and Y. Nambu. Progress Theoret. Phys. (Japan) 5, 307-10(1950) Mar.-Apr. (Letter to the editor)

While accounting satisfactorily for the behavior of an electron in an electromagnetic field, the Tomonaga-Schwinger quantum electrodynamics leaves many questions unsolved when the meson is considered. A calculation, involving observable quantities only, is made here of the electromagnetic correction to the meson charge current. With the aid of a relativistic extension of the Duffin-Kemmer method, the formal analogy with the electron is used as far as possible. The result is identical with that of the usual Proca and Klein-Gordon formalisms.

1089

ON THE INTERACTION OF VECTOR MESONS WITH NUCLEONS. Suraj N. Gupta. Proc. Cambridge Phil. Soc. 46, 649-50(1950) Oct.

It is indicated that vector mesons may be described by a matrix formulation (Kemmer, Proc. Roy. Soc. (London) 173A, 91(1939)). A method is described for introducing the interaction between the vector mesons and the nucleons in the matrix based on a previously formulated method (Harish-Chandra, Proc. Roy. Soc. (London) 186A, 501(1946)).

1090

ON THE NATURE OF τ MESONS. I. Hiroshi Fukuda, Satio Hayakawa, and Yoneji Miyamoto. Progress Theoret. Phys. (Japan) 5, 283-304(1950) Mar.-Apr.

The mass and half life of τ mesons, and their interaction with nucleons, as observed in photoemulsions, are qualitatively discussed. The probabilities of processes $\tau \rightarrow \pi + \pi^0$ and $\tau \rightarrow \pi + \gamma$, for various coupling combinations, are calculated by the Tomonaga-Schwinger formalism. After presentation of a general selection rule for a system of many mesons, particular meson types, such as the scalar and the pseudoscalar, are used in an explanation of the rather long lifetime of the τ meson. Thus, the half life of the process $\tau = 3\pi$ is found by this method to be 10^{-11} sec, in accordance with the experiment. This result points to a very weak interaction between the π meson and a nucleon. Particles called varitrons should be classified as π and μ types of mesons. (auth)

NEUTRONS

1091

Nuclear Development Associates, Inc.
INTERIM REPORT OF THE FAST NEUTRON DATA PROJECT. B. T. Feld, H. Feshbach, M. L. Goldberger, and V. F. Weisskopf. Aug. 1, 1950. 102p. (NYO-632)

The project is concerned with the study of nuclear reactions involving neutrons, including the collection of all available experimental data on fast neutron reactions and the prediction, at least qualitatively, of cross sections and yields of reactions as yet unobserved. The activities of the project reported on here involve the following subjects: collection of experimental data (Section I); analysis of neutron resonances, particularly scattering resonances in the region above 1 kev (Section II); a study of the yield of nuclear reactions and the energy distribution of reaction products (Section III); discussion of the energy distribution of the γ radiation emitted immediately following neutron capture (Section IV); and miscellaneous data, mainly on the analysis of some recent experiments on inelastic scattering (Section V).

1092

Atomic Energy Research Establishment
APPROXIMATE DETERMINATION OF NEUTRON SPECTRUM FOR THE CASE OF $1/V^{\alpha}$-ABSORPTION CROSS SECTION. M. E. Mandl. Aug. 1950. 15p. (AERE-T/R-560)

An approximate formula is derived for the neutron absorption energy spectrum in an infinite medium of a pure substance and an estimate is made of the relative error incurred in using this approximation to evaluate certain types of integrals over the neutron absorption energy spectrum.

1093

DETERMINATION OF THE INTENSITY OF A NEUTRON SOURCE. A. Bracci, U. Facchini, and E. Germagnoli. Nuovo cimento 7, 881-91(1950) Oct. 15. (In Italian)

The absolute intensity of a Raα + Be source of neutrons (501.87 mg Ra) was measured in the following way: a distribution curve in water was obtained through bombardment of thin In foils; then, the yield of the counting system was evaluated by bombarding the same foils with a thermal neutron flux of known intensity. The source intensity was found to be $(3.01 \pm 0.15) \times 10^6$ neutrons/sec. (auth)

1094

SLOW NEUTRON CROSS SECTIONS OF MOLYBDENUM AND BROMINE. P. A. Egelstaff and B. T. Taylor. Nature 166, 825-6(1950) Nov. 11. (Letter to the editor)

The total neutron cross sections of Mo and Br have been measured between 0.05 and 10 ev using a crystal spectrometer, and between 0.0025 and 0.1 ev using a mechanical time-of-flight spectrometer. In the region from 0.0025 to 0.03 ev the elastic scattering cross section of Mo has been calculated from the theory of the transmission of slow neutrons through microcrystalline materials, and the theoretical curve has been obtained by adding to these values the absorption cross section deduced from the experimental results. The absorption cross section of Mo at 0.025 ev was measured using the pile-oscillator method, and a value of 2.95 ± 0.15 barns obtained. The best value of the absorption cross section at 0.025 ev, deduced from all the data given here on Mo, is 2.7 ± 0.1 barns. The free scattering cross section calculated from this value is 6.3 barns. The total cross section of Br as a function of energy is shown, of which the experimental points are best fitted by the equation:

$$\sigma_t = 6.2 + \frac{1.1}{\sqrt{E}} \text{ barns.}$$

Values of 6.2 ± 0.2 barns for the Br scattering cross section and 6.9 ± 0.3 barns for the absorption cross section at 0.025 ev were obtained.

NUCLEAR PHYSICS

1095

Case Institute of Technology
NUCLEAR PHYSICS PROGRAM; PROGRESS REPORT FOR THE PERIOD NOVEMBER 1, 1949, TO JUNE 30, 1950. June 30, 1950. 28p. (COO-17)

Results of studies on the following are presented: general performance, energy calibration, and maximum energy limitation of the betatron, angular distribution of radiation from the betatron, radiation monitoring, ion injector guns, electron beam ejection, research instrumentation, a pair spectrometer, the Compton effect, the use of nuclear-track plates, Victoreen R thimble meter testing, scattering of γ rays by nucleons, the Dirac theory of spin ½ particles and its nonrelativistic limit, nonrelativistic Hamiltonians for spin ½ particles, phenomenological theory of exchange currents in nuclei, energy degeneration of cosmic ray primaries, scattering of high energy electrons by protons, deviations of nuclear magnetic moment from the Schmidt limits, the lower bound on the range of the triplet neutron-proton interaction, and spectral transmission of γ rays traversing matter.

1096

University of California Radiation Laboratory
SUMMARY OF THE RESEARCH PROGRESS MEETING, JUNE 22, 1950. Henry P. Kramer. Oct. 25, 1950. 10p. (UCRL-786)

Effects of Altitude on Iron Turnover. Studies in Human Subjects. R. Huff. Because the turnover rate of Fe in red blood cells is very small, the use of radioiron permits the measurement of the volume of red cells in the blood. Moreover, since red cells are produced and mature in the bone marrow, a measurement of the rate of change of quantity of iron tracer in the bones will yield the rate of production of new red cells. Conclusions drawn from tests made are that both (Peru) natives and medical students seem to exhibit the same red-cell lifetime. The natives, however, have a higher production rate of red cells.

High Resolution Coincidence Circuits. L. Neher. A coincidence circuit whose predominant advantages are high resolution and a response of about 10^{10} cts/sec has been developed. A schematic of the circuit is given. The principle of operation is essentially that of a Wheatstone bridge.

High Resolution Coincidence Circuit. L. Wouter. The principle of operation of the circuit is laid out schematically. Pulses from two photomultipliers are applied to the two sets of plates of an oscilloscope, producing crossed electric fields. As one pulse builds up it deflects the electron beam along one axis on the oscilloscope screen until a maximum deflection is reached at which time the electron beam starts to recede until it reaches its equilibrium position coincident with the origin on the screen. A pulse on the other set of plates produces a similar deflection in the perpendicular direction. The sum of both deflections produces a trace on the phosphor-coated oscilloscope screen that is a variant of a "Lissajous" figure.

1097

University of California Radiation Laboratory
SUMMARY OF THE RESEARCH PROGRESS MEETING, JULY 6, 1950. Henry P. Kramer. Oct. 25, 1950. 9p. (UCRL-858)

Experimental work concerning the following was discussed: x rays of Cm, Np, and Pu; scattering of mesons in photographic emulsions; and γ rays from π^- capture in hydrogen.

1098

University of California Radiation Laboratory
SUMMARY OF THE RESEARCH PROGRESS MEETING OF NOVEMBER 2, 1950. Henry P. Kramer. Nov. 16, 1950. 7p. (UCRL-997)

Meson Detection by π^+ Decay. M. Jakobson. The mean decay time of the π^+ meson into a μ^+ meson has been measured by means of a counting system developed by A. Schulz, J. Steinberger, and the author. If a meson passes through two crystals it releases a scintillation in each of the crystals and thus gives rise to two essentially simultaneous

pulses generated by photomultipliers that view the crystals. These two pulses are fed into a coincidence circuit. The firing of this coincidence circuit releases a gate after a delay of the order of 10^{-8} sec. If, during the time that the gate is open, a pulse appears, the entire event is counted and is regarded as the decay of a π^+ meson into a μ^+ meson.

Half Lives for α Decay of Polonium Isotopes. D. Karraker. In order to supplement the family of empirical curves of log $\tau_{1/2}$ versus E_α for even-even α emitters by the inclusion of Po isotopes that decay by α emission, it is necessary to determine either the branching ratio or the half life for decay of K-capturing Po isotopes. To this end, the high energy tails of the yield curves of (p,xn) reactions on bismuth were measured in the 184-in. cyclotron. By counting α activity it was possible to compute the yield and hence the cross section of that portion of each Po isotope which subsequently decayed by α emission.

Stars in Emulsions Produced by X Rays. R. Miller. Plates were exposed to the x-ray beam of the synchrotron and the number of stars produced by these x rays in the emulsion of Il C-2 plates was counted as a function of the number of prongs for different energies.

NUCLEAR PROPERTIES

1099

Knolls Atomic Power Laboratory and Cornell University
NEUTRON CAPTURE CROSS-SECTIONS AND LEVEL DENSITY. (abstract) H. Hurwitz, Jr., and H. A. Bethe. Nov. 15, 1950. Decl. Dec. 15, 1950. 3p. (AECD-3020)

Fluctuations of neutron capture cross sections and nuclear binding energies which are related to whether the neutron and proton numbers are odd, even, or magic can be correlated qualitatively by the hypothesis that the significant quantity in determining level densities is the excitation energy measured not from the ground state but from a characteristic level which depends in a smooth way on the number of neutrons and protons in the nucleus. This hypothesis implies that the neutron capture cross section is determined primarily by the binding energy of the target nucleus rather than by that of the final nucleus. Evidence in support of this conclusion is presented.

1100

Oak Ridge National Laboratory
THE TOTAL NEUTRON CROSS SECTIONS OF Ni^{58} AND Ni^{60}. C. P. Stanford. Dec. 11, 1950. 58p. (ORNL-875)

In an attempt to determine which Ni isotope is responsible for the anomalously high Ni scattering cross section for neutrons, the total cross sections of $Ni^{58}O$ and $Ni^{60}O$ have been measured as functions of neutron energy between 0.025 and 0.5 ev. A highly collimated beam of neutrons from the ORNL pile, monochromatized by reflection from a quartz crystal, was used in this experiment. The experimental results are discussed extensively with respect to all types of scattering. It is concluded that Ni^{58} is responsible for the high scattering cross sections of normal Ni.

1101

THE BINDING ENERGY OF ^4He. A. H. Wapstra. Physica 16, 611-16(1950) July-Aug.

Attention is called to the very incomplete state of precise and reliable information concerning the binding energy of He^4. A thorough examination is made of recent determinations by various methods and suggestions are offered as to the most profitable lines of approach.

1102

THE DENSITY DISTRIBUTION INSIDE NUCLEI AND NUCLEAR SHELL STRUCTURE. W. J. Swiatecki. Proc. Phys. Soc. (London) 63A, 1208-18(1950) Nov. 1.

A method of evaluating the density distribution of particles inside a heavy nucleus is described. The results are used to show that the electrostatic repulsion between protons is too weak to produce a nucleus sufficiently hollow to explain the observed "closed shells" at N, Z = 50, 82. (auth)

1103

ELECTRIC QUADRUPOLE MOMENTS OF ATOMIC NUCLEI. F. Filippazzi. Nuovo cimento 7, Supplement No. 1, 12-53(1950). (In Italian)

An outline is made of the present state of knowledge of nuclear electric quadrupole moments. It includes a theoretical discussion, a description of experimental methods, and an account of measurement results and the latter's theoretical implications. 26 references.

1104

ENERGY LEVELS OF LIGHT NUCLEI. III. W. F. Hornyak, T. Lauritsen, P. Morrison, and W. A. Fowler. Revs. Modern Phys. 22, 291-372(1950) Oct.

Pertinent facts appearing in the literature pertaining to the location and character of the excited states in the light nuclei have been summarized and presented in a systematic way. The present article contains a summary of the information appearing in earlier papers (Hornyak and Lauritsen Revs. Modern Phys. 20, 191(1948) and Lauritsen, NRC Preliminary Report No. 5 (1949)) and is intended to supersede them entirely. The range of the survey has been increased to include a discussion of all the light nuclei up to and including neon. With the exception of the nuclei with $A \leq 4$ and a few cases with larger A, each nucleus discussed in this report is represented in a separate diagram on which the known levels are plotted, located according to excitation energy on a vertical scale. On each diagram and plotted to the same energy scale are the various nuclear transitions by which the levels are identified, both as to method of formation and mode of decay. Thus, each diagram contains a representation of the nuclear reactions in which the nucleus in question occurs as either the compound or the residual member. ~1150 references.

1105

GAMMA-NEUTRON CROSS SECTIONS. H. E. Johns, L. Katz, R. A. Douglas, and R. N. H. Haslam. Phys. Rev. 80, 1062-8(1950) Dec. 15.

A method is outlined for determining the total number of photons at each energy for a given irradiation from a betatron, assuming the bremsstrahlung photon distribution to be represented by an equation of Schiff (Phys. Rev. 70, 87, (1946)) and the response of an r-meter to be proportional to the absorption cross section for photons in the wall material. The resulting activities produced by (γ,n) reactions in Cu^{63}, Cu^{65}, Sb^{121}, Sb^{123}, and Ta^{181} have been measured as functions of the maximum photon energy of the betatron. In each case the activity was normalized to saturation per gram for 100 r of radiation. A method is also outlined whereby these activation curves may be analyzed to give the photo-neutron cross section as a function of energy. The cross section for Cu^{63} obtained by this method has its maximum at 17.5 Mev with a resonance half width of 6 Mev and an integrated area of 0.7 Mev-barn. Maxima for the other nuclides are at somewhat lower energies and have essentially the same half width. (auth)

1106

NUCLEAR ENERGY LEVELS, Z-11 TO 20. D. E. Alburger and E. M. Hafner. Revs. Modern Phys. 22, 373-85(1950) Oct.

A compilation has been made which summarizes the present status of nuclear spectroscopy in the medium-light elements from Na to Ca. Table I lists nuclear levels for isotopes from Z = 11 up to and including Z = 20 in order of increasing excitation energy. Table II shows the way in which the various resonance binding energies were obtained. ~160 references.

NUCLEAR REACTORS

1107

NUCLEAR REACTORS. Chem. Eng. 58, 113-16(1951) Jan.

The government will now permit publication of certain information on the design, construction, and operation of specified low-power reactors used for research. Four reactors are therefore described in this article as follows: (1) the world's first nuclear reactor, constructed from uranium and graphite in 1942 (subsequently dismantled); (2) a modified version of the first reactor, located at the Argonne National Laboratory; (3) a uranium and heavy-water reactor located at the Argonne National Laboratory; and (4) a "homogeneous" enriched uranium light-water reactor located at the Los Alamos Scientific Laboratory.

NUCLEAR TRANSFORMATION

1108

Brookhaven National Laobratory
DIRECT PHOTOELECTRIC EFFECTS IN NUCLEI. Ernest D. Courant. [nd.] 24p. (AECU-983)

The unexpectedly large (γ,p) cross sections found in many moderately heavy nuclei are interpreted in terms of a direct photoelectric effect. The γ-ray quantum is supposed to be absorbed by one proton in the nucleus, which is then emitted without the formation of an intermediate compound nucleus. The cross section for this process is small compared to that for the formation of a compound nucleus (which would almost always lead to the eventual emission of a neutron), but it has to be only a few millibarns in order to account for the experimental results. It is shown that, if the nucleus is represented by a square-well potential, the calculated cross sections turn out to be somewhat smaller than the experimental ones, but much larger than those obtained from the statistical theory. The remaining discrepancy can be at least partly removed by assuming a "wine bottle" potential as suggested by Feenberg, or by taking an α-particle model. The angular distribution of the emitted protons should be of the form $A + B \sin^2\theta$, where θ is the angle between the incoming photon and the proton, and the ratio B/A depends on the angular momentum of the proton in the nucleus. This is confirmed by experimental results; from the experimental values of B/A it appears that protons with $l = 0$ in the nucleus contribute considerably to the effect in Rh and Ag. The "wine bottle" potential can account for this, while the square well can not. The theory is applicable to fast photoneutron emission as well, and recent experiments by Poss show that fast photoneutrons are indeed emitted anisotropically. It is suggested that similar direct interaction mechanisms may account for the deviations of (n,p) cross sections from those predicted by the theory, as found recently by Wäffler. (auth)

1109

Los Alamos Scientific Laboratory
THE INTERACTION OF TRITONS WITH PROTONS AND TRITONS. Arthur Hemmendinger. July 1950. 21p. (TID-372)

A series of experiments with the Los Alamos electrostatic generator are reported. Tritium targets were bombarded with 0.5- to 2.5-Mev protons, and elastic scattering, the p-n reaction, and the p-γ reaction were observed. Absolute cross sections were measured wherever feasible, and the results yield some information concerning the nature of the compound nucleus. The same tritium targets were also bombarded with tritons. In addition to the three-body disintegrations, α-particle groups were observed which correspond both to the formation of He^5 and to the emission of a dineutron n_0^2. 27 figures.

1110

Catholic University of America
ANGULAR DISTRIBUTION OF THE ALPHA PARTICLES FROM THE BOMBARDMENT OF Li^7 WITH PROTONS. F. L. Talbott, A. Busala, and G. C. Weiffenbach. Sept. 1950. 20p. (NP-1888)

The angular distribution of the α particles from the reaction Li^7 $(p,\alpha)\alpha$ has been investigated from 0.5 to 1.4 Mev using a photographic emulsion technique. Values of the coefficients of the $\cos^2\theta$ and $\cos^4\theta$ terms are given and compared with the results of other observers. (auth)

1111

ANGULAR DISTRIBUTIONS OF PROTONS FROM THE REACTION $O^{16}(d,p)O^{17}$. Hannah B. Burrows. Phys. Rev. 80, 1095(1950) Dec. 15. (Letter to the editor)

Protons from $O^{16}(d,p)O^{17}$, with O^{17} left in the ground state, show a sharp maximum in intensity at 34 deg (center-of-mass system), a minimum at 85 deg, and a smaller maxi-

mum at 120 deg. With O^{17} left in its first excited state there is a minimum at 33 deg and a maximum at 45 deg. It is suggested that the difference lies in the spins and parities and that (d,n) and (d,p) angular distributions may be of use in determining the spins and parities of ground and excited states in many nuclei.

1112

DETERMINATION OF THE ENERGY OF PHOTO-NEUTRONS LIBERATED FROM DEUTERON BY RADIUM C GAMMA-RAYS. Kiichi Kimura. Mem. Coll. Sci. Kyoto Imp. Univ. 22A, 225-36(1939) July.

The author studied in detail the photoneutrons liberated from deuterium and beryllium by RaC γ rays, and especially determined, for deuterium, the thickness of paraffin wax which was necessary to slow them down to the energy of the resonance absorption of iodine. From this it was ascertained that 2.198-Mev γ rays really do cause the disintegration of deuterium, and the initial energy of the liberated neutrons was estimated to be between 0.001 and 0.0076 Mev. Hence the binding energy of the deuteron was 2.189 ± 0.007 Mev, which gave the neutron mass 1.00895. The relative atomic cross section for the photodisintegration of deuterium with respect to beryllium was $\sigma_D : \sigma_{Be} =$ 1:13. 16 references. (auth)

1113

LIBERATION OF FAST NEUTRONS IN THE NUCLEAR EXPLOSION OF URANIUM IRRADIATED BY THERMAL NEUTRONS. Tokutaro Hagiwara. Mem. Coll. Sci. Kyoto Imp. Univ. 23A, 19-32(1940) Jan.

Fission neutrons liberated from U subjected to neutron irradiation were studied to determine the separate effect due to thermal neutrons alone. Uranium oxide was either screened from or exposed to primary thermal neutrons by use of a Cd sheet shield interposed between the neutron source and the oxide. The comparison between the photographically recorded counts of neutrons per definite time interval measured with and without the Cd shield allowed the detection and measurement of the net gain in the number of the fast neutrons released from uranium. By a number of sets of such alternating measurements it was possible to ascertain the remarkable net increase of the secondary fast neutrons caused by absorbing the thermal neutrons alone. In this way, the average number of fast neutrons liberated per fission of U induced by a thermal neutron was found to be 2.6. From considerations of the amount of energy (about 10 Mev) possessed by the fission neutrons, it is probable that the neutron release takes place immediately after the main division of the compound nucleus instead of simultaneously with the explosion.

1114

THE NEUTRON YIELD FROM THE $C^{13}(p,n)N^{13}$ REACTION. R. E. Adamson, Jr., W. W. Buechner, W. M. Preston, Clark Goodman, and D. M. Van Patter. Phys. Rev. 80, 985-7 (1950) Dec. 15.

The neutron yield from $C^{13}(p,n)N^{13}$ has been studied up to a proton energy of E_p = 3.96 Mev. A magnetically analyzed beam of protons from an electrostatic accelerator was used to bombard a thin target of C^{13}-enriched KCN evaporated onto a Ta sheet. A resonance was found at E_p = 3.76 Mev which corresponds to an excited state in N^{14} at 11.07 Mev and coincides with a previously reported level deduced from the reactions of deuterons on C^{12}. This finding furnishes evidence that the same state of a compound nucleus can be excited by two entirely different processes.

1115

NUCLEAR FISSIONS. II. Cecilia Mossin Kotin. Ciencia e invest. (Buenos Aires) 6, 491-500(1950) Nov. (In Spanish)

A short review is given of some of the results obtained during the investigation of the products of some nuclear fission reactions. Charge and mass distributions of the fragments, their energy, and the emission of delayed neutrons are among the topics examined. 42 references.

1116

ON THE PHOTO-DISINTEGRATION OF THE DEUTERON BY LITHIUM AND FLUORINE γ RAYS. P. V. C. Hough. Phys. Rev. 80, 1069-75(1950) Dec. 15.

The photographic emulsion has been used to measure the differential cross section for the photodisintegration of the deuteron by 6.1- and 7.0-Mev γ rays, and by 14.8- and 17.6-Mev γ rays. Because of the pair production and Compton secondaries produced, a thin Pb foil placed directly before a sufficiently large counter exposed to the high energy γ rays contributes an additional counting rate just equal to the number of absorption processes per second occurring in the foil. Since the total cross section for the γ-ray absorption in Pb is known from the work of Walker (Phys. Rev. 76, 527(1949)), measurement of this additional counting rate gives the incident γ-ray intensity. This method for the absolute measurement of γ-ray intensities leads to an absolute value for the total cross section at 17.6 Mev of $(7.2 \pm 1.5) \times 10^{-28}$ cm^2. The results are in agreement with the theory for a "free" deuteron P wave, but are not sufficiently accurate to fix with greater precision any of the parameters in the neutron-proton potential.

1117

PROTON GROUPS FROM THE DEUTERON BOMBARDMENT OF BORON. William O. Bateson. Phys. Rev. 80, 982-4 (1950) Dec. 15.

Protons emitted when boron enriched to 96% B^{10} was bombarded by 3.76-Mev deuterons have been observed at 90 and 0 deg. Groups corresponding to Q values of 9.18 ± 0.05, 7.03 ± 0.06, 4.70 ± 0.06, 4.15 ± 0.08, 2.26 ± 0.07, 1.36 ± 0.07, 0.70 ± 0.10, and 0.32 ± 0.10 Mev were found. These have relative intensities at 90 deg of 1, 0.3, 0.8, 0.6, 16, 13, and 0.8. The intensity of the lowest-energy group was not determined since it was only just distinguishable from the scattered beam. (auth)

1118

THE REACTION $Li^7(\gamma,p)He^6$. E. W. Titterton. Proc. Phys. Soc. (London) 63A, 1297-8(1950) Nov. 1. (Letter to the editor)

Becker et al. (Phys. Rev. 71, 466(1947)) reported finding a β^- emitter (1 sec) following irradiation of Li with γ rays from a 20-Mev betatron; assuming this to be He^6 from the

$Li^7(\gamma,p)$ reaction, they determined the threshold of the reaction as 9.5 ± 0.3 Mev. The present author finds a definite evidence of the reaction $Li^7 + h\nu = H^1 + He^6 - 10.1$ Mev in several track pictures obtained by exposing Li-loaded emulsions to radiations from $Li^7(p,\gamma)Be^8, Be^{8*}$.

1119

Atomic Energy Research Establishment
STARS PRODUCED IN NUCLEAR EMULSIONS BY 150-MEV NEUTRONS. E. W. Titterton. [nd.] 8p. (AERE-G/M-74)

A fast neutron beam, obtained from the Harwell cyclotron by bombarding a Be target with 170-Mev protons, has been used to irradiate C_2, G_5 and NT_4 plates and the neutron-induced stars have been studied. The neutron spectrum is indicated and gives a maximum yield at 150 Mev. The neutron flux was determined by integration and includes neutrons from 60 Mev to the maximum of the spectrum. At the plate location the flux was 2×10^5 n/cm²/sec. Five thousand stars have been examined. Results are discussed briefly.

PARTICLE ACCELERATORS

1120

University of California Radiation Laboratory
PRESENT STATUS OF THE BEVATRON R-F SYSTEM. J. Riedel. Apr. 26, 1950. 4p. (UCRL-699)

A block diagram shows the general layout of the bevatron frequency-tracking system. A short description is given of the function of the various units, with a note about their present status. A block diagram of monitoring circuits is shown and their principle of operation and present status are described.

1121

BEAM OSCILLATIONS IN AN F-M CYCLOTRON. T. Teichmann. J. Applied Phys. 21, 1251-7(1950) Dec.

The radial and vertical oscillations of a synchrocyclotron beam are considered. It is found that various oscillations of substantially constant or increasing amplitude may occur in certain regions of the field, in which there are angular or other asymmetries, although only one possible oscillation (that at $n \propto \frac{1}{3}$) can occur in a field that is cylindrically and vertically symmetric. The conditions for the various oscillations, and their behavior, are discussed. (auth)

1122

Case Institute of Technology
FLUX-FORCING AND ITS INFLUENCE ON THE ADIABATIC EQUILIBRIUM RADIUS IN A FIELD-BIASED BETATRON; TECHNICAL REPORT NO. 5. E. C. Gregg, Jr. Aug. 15, 1950. 22p. (NP-1811)

The flux-forced field-biased betatron is described in detail, with certain design equations and other factors pertinent to its operation. Treated also is the influence of the flux feedback on the adiabatic equlibrium radius and the corresponding limitations to such a machine. Methods are described for measuring these factors. 10 figures. (auth)

1123

Atomic Energy Research Establishment
THE PERFORMANCE OF THE HARWELL 110-IN. SYNCHROCYCLOTRON. J. B. Adams and A. O. Edmunds. Aug. 1950. 35p. (AERE-G/R-568)

The performance of the synchrocyclotron, in operation at AERE Harwell since December, 1949, is assessed in the light of current theory. General parameters, forced oscillations, free oscillations, mean beam intensity as a function of radius, nature of the current pulse on an internal target, and miscellaneous data are reviewed.

RADIATION ABSORPTION AND SCATTERING

1124

Brookhaven National Laboratory and Argonne National Laboratory
SCATTERING AND POLARIZATION OF NEUTRONS IN AN IRON SINGLE CRYSTAL. M. T. Burgy, D. J. Hughes, and W. E. Woolf. Aug. 31, 1950. 10p. (AECU-1060)

The total neutron cross section of a single crystal of iron containing 10% by weight of silicon has been measured with monoenergetic neutrons. Previously obtained results for a polycrystalline sample also are included. The single-crystal cross section is much smaller than that of the polycrystal, especially in the region just above the "cut-off" velocity (980 m/sec, below which velocity the polycrystal exhibits no coherent scattering). The scattering cross section, obtained by subtraction of the capture cross section, is given. The polarization, which would result from inelastic scattering but not from other incoherent scattering, was found by magnetizing the crystal in a field of 11,000 oersteds and measuring the single transmission effect, E_s, the fractional increase in transmitted neutron intensity resulting from magnetization to saturation. The observed E_s is consistent with the assumption that the incoherent scattering in iron is largely inelastic.

1125

Brookhaven National Laboratory
HIGH ENERGY NEUTRON SCATTERING BY NUCLEI. Simon Pasternack and Hartland S. Snyder. Sept. 26, 1950. 5p. (AECU-1075)

Differential scattering cross sections for 90-Mev neutrons on nuclei, calculated on the basis of the "transparent" nuclear model (Serber, Phys. Rev. 72, 1114(1947)) in which the nucleus is represented by a square well with 30.8-Mev potential plus absorption, differ from the experimentally observed values (Bratenahl et al., Phys. Rev. 77, 597(1950)) at low scattering angles. An exact partial wave analysis has now been made for Al, using this model, and it is concluded that the apparent deviations are at least partly due to the calculational method that has been used; i.e., to the classical (WKB) approximation. The scattering and absorption cross sections for Al become 0.83 and 0.45 barns, respectively, when calculated by the exact partial wave analysis.

1126

Brookhaven National Laboratory and New York University
SMALL ANGLE SCATTERING OF NEUTRONS. R. J. Weiss. Oct. 26, 1950. 72p. (AECU-1112)

The differential and total scattering cross sections have been calculated for slow neutrons impinging on crystalline spheres whose radii are very much greater than the neutron wavelength. This has been done by the method of partial waves using the WKB (Wentzel-Kramers-Brillouin) approximation for determining the phase shifts. The results for the differential cross section show that when the difference, ρ, between the neutron phase shift in traversing the particle diameter and the phase shift in traversing the same distance in vacuo is small the result agrees with the Born approximation, while if ρ is large the result agrees with that obtained by geometrical optics. It is further shown that the total cross section for ρ small is $\pi R^2\rho^2/2$ and for ρ large is $2\pi R^2$ where R is the particle radius. The broadening of a neutron beam in traversing finely divided materials was measured, using the Oak Ridge reactor, as a function of the neutron wavelength, particle size, and coherent scattering cross section and verified the foregoing considerations. A new method for determining the coherent cross section of nuclei and the phase of slow neutron scattering is demonstrated through the use of a liquid of known index of refraction into which the finely divided materials are immersed. In this manner the phases of Mo, Cb, Pd, Ru, Si, P, Cr, and Te are shown to be positive. The coherent cross section of Cr and Si exhibit very little incoherent scattering. The small angle scattering in unmagnetized ferromagnets is experimentally verified. (auth)

1127

Oak Ridge National Laboratory
IONIZATION AND EXCITATION LOSSES OF CHARGED PARTICLES OF INTERMEDIATE ENERGIES. Jacob Neufeld. Dec. 14, 1950. 19p. (ORNL-884)

A method has been outlined for determining energy losses of charged particles of intermediate energies; i.e., which do not carry bound electrons and have velocities lower than the K-shell velocity of the stopping atom. The "free collisions" and the "resonance effects" have been separately evaluated. The number of electrons participating in free collisions has been determined by using the Thomas-Fermi model for the stopping atom, and the energy loss has been evaluated by means of the Rutherford formula. The resonance effects have been calculated by means of an expression derived by Fermi which represents a much better approximation than the usual logarithmic formula. The stopping power of a few elements has been computed, and the results are compared with experimental data. (auth)

1128

University of California
THE SCATTERING OF 31.8-MEV PROTONS BY PROTONS USING PROPORTIONAL COUNTER DETECTORS. Lawrence Harding Johnston. 1950. 52p. (UCRL-634)

The basic experiment consists in causing a beam of protons to impinge upon an accumulation of relatively stationary protons (hydrogen gas) and to measure the number of protons scattered as a function of the scattering angle. A description of the arrangement and alignment of equipment with the 32-Mev beam of the Berkeley linear accelerator is included. The data have been analyzed statistically and results have been indicated. 24 references.

1129

University of California Radiation Laboratory
EXPERIMENTS ON ELASTIC P-P SCATTERING IN THE ENERGY RANGE 120 TO 345 MEV. O. Chamberlain, E. Segrè, and C. Wiegand. Nov. 10, 1950. 5p. (UCRL-1003)

Measurements are reported on p-p scattering at 340 Mev made with gas proportional counters improved and extended by using stilbene scintillation counters in coincidence and by varying the energy of the beam by the use of lithium absorbers. The results are summarized in a chart which gives the differential scattering cross section in the center of mass system, as a function of the angle in the center of mass system.

1130

BETA AND GAMMA RADIATION. PART II. THE NATURE AND PROPERTIES OF γ-RADIATION. J. V. Jelley. Atomics (London) 2, 5-12, 32(1951) Jan.

The discussion, following a description of the γ type of radiation and reference to quantized radiation, covers nuclear instability resulting in γ-ray emission, "capture γ rays," γ rays from a residual nucleus formed in a nuclear reaction, γ rays from inelastic scattering, γ rays associated with β radiation, interaction of γ rays with matter, the photoelectric effect, the Compton effect, pair production, and resultant absorption coefficients.

1131

THE RELATIVISTIC THEORY OF SCATTERING IN COULOMB FIELD BY ATOMS. K. C. Kar, S. Sengupta, and P. P. Chatterji. Indian J. Phys. 24, 339-45(1950) Aug.

Relativistic theory of nuclear scattering of electrons has been considered from the wave-statistical point of view. It has been shown that to a first-order relativistic approximation the ordinary hydrodynamical wave equation is slightly modified. On deriving the well-known χ equations with the help of the modified equation, a new term in interaction energy is obtained which together with the other well-known interaction terms gives the correct scattering formula. (auth)

1132

Division of Mathematical and Physical Sciences, NRC
SATURATION BACKSCATTERING OF β RAYS, paper 4 of CONFERENCE ON ABSOLUTE β COUNTING; PRELIMINARY REPORT NO. 8. (Based on: AECU-567; MON-C-397). L. R. Zumwalt. Oct. 1950. 4p. (NP-1813 (paper 4))

Some data on saturation backscattering which have been obtained in connection with the work on absolute β counting carried out at the Oak Ridge National Laboratory are reported. These data, which provide for only a very limited coverage of this subject, deal with the thickness of material for attainment of a saturation backscattering, and the energy, intensity, and angular distribution of backscattered ra-

diation. A brief discussion is presented of the relation of some of the experimental observations to the theoretically expected behavior of electrons in undergoing multiple scattering. This work is reported in much greater detail in "Absolute Beta Counting using End-window Geiger-Mueller Counters and Experimental Data on Beta-particle Scattering Effects," AECU-567 (see NSA 3-2295). 9 figures.

1133

Division of Mathematical and Physical Sciences, NRC
THEORETICAL CONSIDERATIONS IN β-RAY SCATTERING AND ABSORPTION, paper 6 of CONFERENCE ON ABSOLUTE β COUNTING; PRELIMINARY REPORT NO. 8. G. L. Brownell. Oct. 1950. 6p. (NP-1813(paper 6))

The empirical relations of β-ray absorption and scattering indicate that the energy spectrum and angular distribution of a beam of β rays may not change greatly in traversing matter. The limiting case is very amenable to calculations, and a comparison with theoretical expressions indicates that this limiting case may be essentially correct. Considerable qualitative information can be derived from this formulation, and it is hoped that certain quantitative relations can be shown to be correct. These conclusions are discussed extensively by other members of the conference.

RADIOACTIVITY

1134

Brookhaven National Laboratory
CONVERSION COEFFICIENT OF THE 35-KEV GAMMA RAY OF Te^{125}. G. Friedlander, M. L. Perlman, and G. Scharff-Goldhaber. [nd.] 5p. (AECU-1062)

The 35.4-kev γ rays from a pure Te^{125m} (58-day) source prepared by separation from Sb^{125} have been measured directly with a proportional counter and pulse-height analyzer. The relative peak heights for the K x rays and the γ rays, after corrections for the x-ray fluorescence yield of Te, counter window transmission, counter efficiency, and peak position, give a ratio of K holes to 35-kev γ rays of 17.2. From this ratio and from the previously measured conversion fractions of the 109-kev γ ray the unconverted fraction and the K conversion fraction of the 35.4-kev transition may be calculated provided an assumption is made about the ratio of the K conversion factor to the total conversion. The present experiments establish that the unconverted fraction of the 35.4-kev transitions cannot exceed 0.08 ± 0.01 even if there is no conversion outside of the K shell. According to the theory of internal conversion, the transition therefore is not electric dipole, but would appear to be a mixture of magnetic dipole and electric quadrupole.

1135

Brookhaven National Laboratory
THE DECAY OF Yb^{169}. (abstract) A. W. Sunyar and J. W. Mihelich. Oct. 5, 1950. 1p. (AECU-1067)

The report is reproduced here in its entirety.

It has been reported (De Benedetti and F. K. McGowan, Phys. Rev. 74, 736(1948)), that following K-capture in Yb^{169} (33-day) a converted γ ray of 400 kev is emitted, leading to an isomeric state of 1 μsec lifetime, which decays to the ground state by emission of an internally converted γ ray of 190 kev. Recent work (Cork et al., Phys. Rev. 78, 95 (1950)) has revealed the presence of several γ rays. We have investigated the decay scheme by scintillation counter coincidence techniques. Approximate K/L ratios for the conversion lines obtained with a 180 deg permanent magnet-type spectrograph are of aid in assigning a level scheme. Only K and L x rays of Tm and no γ rays precede the isomeric state. The lifetime of the isomeric state is 6.0×10^{-7} sec, in agreement with an independent measurement by Fuller (Proc. Phys. Soc. (London) 63A, 1044(1950)). The isomeric state is probably 307 kev above the ground state, and decays by three alternative means: (1) the 307-kev ground state transition, (2) a 177-kev γ ray followed by a 130-kev γ ray, (3) a 198-kev γ ray followed by a 109-kev γ ray.

1136

Iowa State College Ames Laboratory
RADIOACTIVITIES OF GERMANIUM, ARSENIC, GALLIUM, AND ZINC. Warren Heiman and Adolf Voigt. June 22, 1950. 17p. (ISC-89)

Radioactivities were produced by the fast (pile)-neutron bombardment of Ge. Chemical separations followed by decay and absorption measurements yielded the following results. Eleven-day Ge^{71} decays with the emission of positrons with maximum energy of 0.65 Mev. Ge^{77} with 12-hr half life emits 0.31-Mev γ rays. The half life of As^{77} is 38.0 ± 0.5 hr and it emits 0.68-Mev β particles and two γ rays. The following new gallium and zinc activities were observed, but not assigned definite mass numbers. A 14.5-day gallium activity emits β particles with energies of 0.29 and 0.71 Mev, 34-kev γ rays and possibly x rays; a 53-hr gallium activity gives off 1.9-Mev β particles and 1.63-Mev γ rays; a 14-day zinc activity decays with the emission of 2.1-Mev β particles and 40-kev γ rays. (auth)

1137

University of California Radiation Laboratory
ISOTOPES OF RUBIDIUM, POLONIUM, AND BISMUTH. D. G. Karraker. Apr. 4, 1950. 73p. (UCRL-640)

A revision of this report, entitled POLONIUM ISOTOPES PRODUCED WITH HIGH ENERGY PARTICLES, by D. G. Karraker and D. H. Templeton, was indexed as UCRL-640 (Rev.) and abstracted as NSA 5-722.

1138

University of California Radiation Laboratory
RADIOACTIVE ISOTOPES OF BISMUTH. (thesis) H. M. Neumann. Apr. 6, 1950. 76p. (UCRL-646)

In a study of α-decay systematics with regard to bismuth an investigation of the α activity at around mass number 200 has been made. This necessitated identification of all the Bi isotopes lighter than mass number 204. Chapter I of this thesis reports results of this investigation and discusses observed α-decay characteristics. Chapter II reports results of investigations carried out on heavier Bi isotopes (mass numbers 207 to 210, inclusive).

1139

INTERNAL CONVERSION IN THE L_I-SHELL. H. Gellman, B. A. Griffith, and J. P. Stanley. Phys. Rev. 80, 866-74 (1950) Dec. 1.

Analytical expressions obtained by Goertzel and Rose (unpublished) for the internal conversion of γ radiation have been simplified, from a computational viewpoint, for the L shell. Complex expressions involving gamma functions and hypergeometric functions are simplified and reduced, in several cases, to algebraic expressions. Numerical calculations have been carried out for the L_I shell, for electric dipole, electric quadrupole, and magnetic dipole radiation. (auth)

1140

MEASUREMENTS OF SHORT-LIVED ISOMERS. W. J. MacIntyre. Phys. Rev. 80, 1018-23(1950) Dec. 15.

The half lives of eight short-lived isomers were investigated by the delayed coincidence method of detecting short lived excited γ states following β emission. Of these, the half life of Hg^{198*} following β decay of Au^{198} was measured as 2.3×10^{-8} sec. Excited states of Mg^{24*}, Hg^{199*}, Ca^{42*}, Nd^{142*}, A^{38*}, Te^{122*}, and Fe^{56*} were found to have half lives shorter than 1 to 2×10^{-8} sec, the lowest value measurable owing to circuit limitations. By means of the measured half lives or upper limits, probable l values, the change in units of angular momentum, were assigned through comparison with the theoretical values of the Segrè-Helmholz formula. Correlation with l values estimated through other methods has resulted in probable assignment of l values for four isomers and upper l values for the remaining four. (auth)

1141

RADIATIONS FROM Mo^{99} AND Tc^{99m}. Merle E. Bunker and Robert Canada. Phys. Rev. 80, 961-5(1950) Dec. 15.

The radiations from Mo^{99} (67-hr) and its metastable daughter Tc^{99m} (6-hr) have been measured in a magnetic-lens spectrograph. The β-ray spectrum consists of a group with an end point energy of 1.23 Mev, one of 0.445 Mev, and possibly a third lower energy group. The relative intensities of the 1.23-Mev to 0.445-Mev groups are 4:1. γ rays have been found at 0.040, 0.140, 0.181, 0.367, 0.741, and 0.780 Mev. The γ rays at 0.040, 0.140, and 0.181 Mev are internally converted. The spectrum of Tc^{99} consists of one internally converted γ ray at 0.140 Mev. A disintegration scheme is proposed. (auth)

1142

RECENT INVESTIGATION OF THE SHAPES OF β-RAY SPECTRA. Chien-Shiung Wu. Revs. Modern Phys. 22, 386-98(1950) Oct.

The present status of β spectra is reported. The following considerations are reviewed: Fermi's theory of β decay; transformation of nucleons; five forms of interaction; two approximations for allowed transitions; Kurie or Fermi plot; investigation of very-low-energy electrons; results from S^{35} and Cu^{64}; more experimental evidence on the validity of Fermi's allowed spectrum in the very-low-energy region, proportional-counter method of investigation, and the H^3 spectrum; allowed transitions of β spectra of the Cu^{61} spectrum; β spectrum of He^6; the three simplest radioactive nuclei: n, H^3, and He^6; significance of forbidden spectra; and remarks on the theory of forbidden transitions.

SPECTROSCOPY

1143

ON THE X-RAY LUMINESCENCE SPECTRA OF THALLIUM-ACTIVATED ALKALI HALIDE CRYSTALS. Aparesh Chatterjee. Indian J. Phys. 24, 331-8(1950) Aug.

The x-ray luminescence spectra of Tl-activated alkali halides have been investigated at ordinary and low temperatures. The band systems are of two types; the visible part is due to the lattice emission, while the short-wavelength part exhibits characteristic Tl emission. The lattice bands gain in intensity due to the presence of Tl. The intensity of the characteristic band is linearly related to the concentration of Tl. It has been shown that Seitz's explanation (J. Chem. Phys. 6, 150(1938)) of the characteristic Tl band emission is inadequate, and an alternative energy-level scheme has been proposed. (auth)

THEORETICAL PHYSICS

1144

ELEMENTARY PARTICLES AND THE FIELD. D. I. Blokhintsev. Uspekhi Fiz. Nauk 42, 76-92(1950) Sept. (In Russian)

The present search for a theoretical foundation of the particle concept, and the tendency toward dissolving it in that of the field, are outlined. Particles appear as an expression of a dispersion of the field into a spectrum of quantized excitations. Difficulties standing in the way of such a treatment (divergences), due to the nonlinear character of real fields, point to the approximate and accidental nature of the particle concept; the dispersion occurs and, consequently, particles are created, only in an approximate manner and in the special case of loosely connected oscillations in a field. Among the works cited are the following: Markov, J. Phys. U.S.S.R. 2, 454(1940); Blokhintsev, Zhur. Eksptl'. i Teoret. Fiz. 16, 480(1946), 17, 66(1947), 18, 566(1948).

1145

A NEW TYPE OF PERTURBATION. Georges Allard. J. phys. radium 11, 646-52(1950) Dec. (In French)

Pauli's interaction term, proportional to the electromagnetic field and accounting for the electron's magnetic moment, can be considered as a vector product of the symbolic vector $\underline{p} + \underline{A}e/c$ by itself. An analogous form is here given to a pseudo-vector and a pseudo-scalar term. In a Coulomb field the latter is identically zero, whereas the former has a shape originally introduced by Uhlenbeck and Goudsmit into the theory of a rotating electron. The results of a perturbation calculation are compared with those obtained by Lamb and Rutherford. (auth)

1146

A NOTE ON EQUATIONS FOR THE MESON. Hideo Yamamoto. Mem. Coll. Sci. Kyoto Imp. Univ. 22A, 37-40 (1940) Mar.

A method of obtaining a tensor formulation of the so-called U-field of Yukawa's theory (Proc. Phys. Math. Soc. Japan 20, 321(1938)) by means of the tensor calculation used in previous papers is described, and a possible scheme of unifying the representations of the Dirac and Yukawa theories is introduced.

1147

ON THE RELATIVISTICALLY IMPROVED INTEGRATION IN PERTURBATION THEORY; ITS MEANING IN FEYNMAN THEORY. Hiroomi Umezawa and Rokuo Kawabe. Progress Theoret. Phys. (Japan) 5, 266-71(1950) Mar.-Apr.

In a previous work (Progress Theoret. Phys. (Japan) 4, 420 (1949)) a method of integration (the "w-method") was introduced in the perturbation calculation, which maintained the essentially relativistic invariance of the quantum field theory. However, the artificial character of the whole procedure is obvious, because the usual perturbation formalism itself is not covariant. Since Feynman theory (Phys. Rev. 76, 769(1949)) is free from this defect, the applicability of the w-method in the latter theory is studied here. It is shown that the method permits the determination of the integral's domain in a relativistically invariant manner.

1148

THE PROBLEM OF ENERGY EIGENVALUES OF CLOSED SYSTEMS IN THE FIELD THEORY. B. Ferretti. Nuovo cimento 7, 899-900(1950) Oct. 15. (Letter to the editor; in Italian)

The problem of the diagonalizing of the Hamiltonian or of the energy eigenvalues in the theory of wave fields has been treated in previous notes for the purely formal case of a continuous eigenvalue spectrum, which admitted the application of the perturbation method (Nuovo cimento 7, 79, 375, 783(1950)). An attempt is made here to extend these considerations to cases of a more immediate physical interest, namely, those involving closed systems of the field of force; the perturbation theory cannot be applied here. As in preceding cases, large use is made of the artifice of adiabatic changes of the charge.

1149

THE PROBLEM OF MANY BODIES IN THE QUANTIZED SPACE-TIME. V. L. Averbakh and B. V. Medvedev. Zhur. Eksptl'. i Teoret. Fiz. 20, 92(1950) Jan. (Letter to the editor; in Russian)

In a previous paper (Doklady Akad. Nauk S.S.S.R. 64, 41 (1949; NSA abstract 3-2363) the authors gave an interpretation of Snyder's (Phys. Rev. 71, 38(1947)) theory of quantized space for the case of one body interacting with a field. It is shown here that their interpretation can be applied to the problem of many bodies.

1150

PROBLEMS OF AMBIGUITY IN QUANTUM FIELD THEORY. Yasuhisa Katayama. Progress Theoret. Phys. (Japan) 5, 272-82(1950) Mar.-Apr.

Some of the mathematical discrepancies of the covariant quantum field theory developed by Tomonaga, Schwinger, Feynman can be termed ambiguities as distinguished from the divergence difficulties. This is illustrated by the fact that the calculation of matrix elements introduces contradictions with the formal requirements of the gauge invariance and of the divergence and equivalence theorems. Even the possibilities offered by the regulator method of Pauli and Villars (Revs. Modern Phys. 21, 433(1949)) do not solve the problem, inasmuch as that method often does not permit a clear separation of physically significant results from nonphysical terms. An analysis of the situation shows that a mathematically consistent theory, free from the foregoing ambiguities, can hardly be constructed. However, it is possible to recur to procedures called "temporary escapes" by the author; an example of such a procedure is given.